VOLUME 14 NUMBER 2 / JANUARY 23, 1976

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N76-10994* + National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 61
Sep. 1975 125 p refs
(NASA-SP-7037(61)) Avail: NTIS HC $4.00 CSCL 01A

This bibliography lists 418 reports, articles, and other documents introduced into the NASA scientific and technical information system in August 1975. Author

N76-10995*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTIMAL CONTROL ALLEVIATION OF TILTING PROPROTOR GUST RESPONSE
Wayne Johnson Aug. 1975 27 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62494; A-6307) Avail: NTIS HC $4.00 CSCL 01B

Optimal control theory is applied to the design of a control system for alleviation of the gust response of tilting proprotor aircraft. Using a proprotor and cantilever wing analytical model, the uncontrolled and controlled gust response is examined over the entire operating range of the aircraft except for hover: helicopter mode, conversion, and airplane mode flight. Substantial improvements in the loads, ride quality, and aeroelastic stability are possible with a properly designed controller. A single controller, nominally optimal only at the design point speed (160 knots here), operated efficiently over the entire speed range, with the possible exception of very low speed in helicopter mode. Kalman-Bucy filters were used as compensation networks to provide state estimates from various measurements in the wing motion, rotor speed perturbation, and tip-path-plane tilt. Author

N76-10996*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ECONOMIC STUDY OF AN ADVANCED TECHNOLOGY SUPERSONIC CRUISE VEHICLE
Cynthia L. Smith and Louis J. Williams Oct. 1975 34 p refs
(NASA-TM-X-62499; A-6333) Avail: NTIS HC $4.00 CSCL 01C

A description is given of the methods used and the results of an economic study of an advanced technology supersonic cruise vehicle. This vehicle was designed for a maximum range of 4000 n.mi. at a cruise speed of Mach 2.7 and carrying 292 passengers. The economic study includes the estimation of aircraft unit cost, operating cost, and idealized cash flow and discounted cash flow return on investment. In addition, it includes a sensitivity study on the effects of unit cost, manufacturing cost, production quantity, average trip length, fuel cost, load factor, and fare on the aircraft's economic feasibility. Author

N76-10997*# Kansas Univ., Lawrence.
PROCEEDINGS OF THE NASA, INDUSTRY, UNIVERSITY, GENERAL AVIATION DRAG REDUCTION WORKSHOP
Jan Roskam, ed. 1975 454 p refs Conf. held at Kansas Univ., Lawrence, 14-16 Jul. 1975
(Grant NsG-1175)
(NASA-CR-145627) Avail: NTIS HC $12.00 CSCL 01A

The conference on drag reduction research aims to improve general aviation aircraft performance. For individual titles, see N76-10998 through N76-11029.

N76-10998* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
GENERAL OVERVIEW OF DRAG c02
S. A. Anderson *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 11-37 refs (For availability see N76-10997 02-01)
CSCL 01A

The state-of-the-art on aerodynamic drag reduction is briefly reviewed. The various elements making up the total drag of an aircraft include fuselage, wing, nacelles, trim, interference, tail, and cooling drag. G.G.

N76-10999* North Carolina State Univ., Raleigh.
PROSPECTS AND TIME TABLES FOR ANALYTICAL ESTIMATION OF THE DRAG OF COMPLETE AIRCRAFT CONFIGURATION c02
Frederick O. Smetana *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 39-41 refs (For availability see N76-10997 02-01)
CSCL 01A

Analytical drag methods and wind tunnel evaluation of aircraft design features are used to identify excessive drag of general aviation aircraft with reciprocating engines. G.G.

N76-11000* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF DRAG CLEAN-UP TESTS IN NASA LANGLEY FULL-SCALE TUNNEL c02
Marion O. McKinney *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 43-60 refs (For availability see N76-10997 02-01)
CSCL 01A

This summary of drag results presents tabulations on fighter aircraft and light twin general aviation aircraft wind tunnel tests. The figures show that the friction drag for light twins is larger than that for the fighters because of the greater wetted area and the smaller wing area used for reference. Full scale tunnel tests developed the following design features contributing to excessive drag: cooling flow system, engine exhaust stacks, landing gears, control surface gaps, and wing irregularities and leakages. G.G.

N76-11001* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMPLIFIED THEORETICAL METHODS FOR AERODYNAMIC DESIGN c05
Jan R. Tulinius *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 61-76 refs (For availability see N76-10997 02-01)
CSCL 01C

The objective of this paper is to describe theoretical procedures which can be utilized by the general aviation industry for aerodynamic design. Discussed are the design process and theoretical methods used to design a wing. Then theoretical methods for estimating the interference velocities due to fuselage, or other bodies, and nacelles are elaborated. It is assumed that flow fields due to different components can be superimposed, and then the pressure coefficients computed from the Bernoulli equation. Methods to estimate the induced, viscous form, and compressible drags are also discussed. In addition, a procedure for modifying the surface contours to reduce adverse pressure distributions induced by component interference is detailed.
Author

N76-11002* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DRAG REDUCTION: BACK TO BASICS **c05**
Oran W. Nicks *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 77-85 refs (For availability see N76-10997 02-01)
CSCL 01C

Aeronautical design engineering for general aviation aircraft considers the iteration of wind tunnel test data are lift, weight, drag, and thrust as the basic balancing factor in drag reduction efforts.
G.G.

N76-11003* Kansas Univ., Lawrence.
SOME COMMENTS ON FUSELAGE DRAG **c05**
Jan Roskam *In its* Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 87-102 refs (For availability see N76-10997 02-01)
CSCL 01A

The following areas relating to fuselage drag are considered: (1) fuselage fineness - ratio and why and how this can be selected during preliminary design; (2) windshield drag; (3) skin roughness; and (4) research needs in the area of fuselage drag.
Author

N76-11004* Beech Aircraft Corp., Wichita, Kans.
PROPELLER BLOCKAGE RESEARCH NEEDS **c05**
R. R. Tumlinson *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 103-105 refs (For availability see N76-10997 02-01)
CSCL 01C

The effect of mutual propeller/nacelle of fuselage interference on aircraft propulsive efficiency is studied in order to determine accurate drag levels from flight test data by accurately estimating installed thrust and drag and the resulting aircraft performance.
G.G.

N76-11005* Massachusetts Inst. of Tech., Cambridge.
PRESERVATION OF WING LEADING EDGE SUCTION AT THE PLANE OF SYMMETRY AS A FACTOR IN WING-FUSELAGE DESIGN **c02**
E. Eugene Larrabee *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 107-115 refs (For availability see N76-10997 02-01)
CSCL 01A

Most fuselage geometries cover a portion of the wing leading edge near the plane of symmetry, and it seems reasonable to expect that a large fraction of the leading edge suction which would be developed by the covered wing at high angles of attack is not developed on the fuselage. This is one of the reasons that the Oswald span efficiency factor for the wing body combination fails to approach the value predicted by lifting line theory for the isolated wing. Some traditional and recent literature on wing-body interference is discussed and high Reynolds number data on wing-body-nacelle drag are reviewed. An exposed central leading edge geometry has been developed for a sailplane configuration. Low Reynolds number tests have not validated the design concept.
Author

N76-11006* Virginia Polytechnic Inst. and State Univ., Blacksburg.
ASYMPTOTIC ANALYTICAL METHODS IN FLUID MECHANICS RELATED TO DRAG PREDICTION **c34**
G. R. Inger *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 117-124 refs (For availability see N76-10997 02-01)
CSCL 20D

Some recent theoretical work of a purely analytical nature is described which promises to provide engineering predictions for the important drag-related phenomena of flow in the stall regime. This analytical work deals with rigorous asymptotic studies of the complete Navier-Stokes equations that govern the viscous flow around any aerodynamic body under conditions where boundary layer separation takes place from the body surface.
Author

N76-11007* Gates Learjet Corp., Denver, Colo.
THE ECONOMIC IMPACT OF DRAG IN GENERAL AVIATION **c05**
Ron D. Neal *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 125-135 refs (For availability see N76-10997 02-01)
CSCL 01C

General aviation aircraft fuel consumption and operating costs are closely linked to drag reduction methods. Improvements in airplane drag are envisioned for new models; their effects will be in the 5 to 10% range. Major improvements in fuel consumption over existing turbofan airplanes will be the combined results of improved aerodynamics plus additional effects from advanced turbofan engine designs.
G.G.

N76-11008* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME METHODS FOR REDUCING WING DRAG AND WING-NACELLE INTERFERENCE **c05**
Thomas C. Kelly *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 137-156 refs (For availability see N76-10997 02-01)
CSCL 01C

Primary efforts directed toward drag reduction centered on the design of both supercritical and subcritical families of airfoils, the reduction of induced drag through the use of vortex diffusers, and the reduction of interference drag for executive-type aircraft.
Author

N76-11009* Kansas Univ., Lawrence.
DRAG REDUCTION THROUGH HIGHER WING LOADING **c05**
David L. Kohlman *In its* Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 157-169 refs (For availability see N76-10997 02-01)
CSCL 01C

A reduction in wing area, thickness, and span increases wing loading and lowers parasitic drag for a typical light airplane by 10.5%.
G.G.

N76-11010* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
USE OF A PITOT PROBE FOR DETERMINING WING SECTION DRAG IN FLIGHT **c06**
Edwin J. Saltzman *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 171-189 ref (For availability see N76-10997 02-01)
CSCL 01D

A wake traversing probe was used to obtain section drag and wake profile data from the wing of a sailplane. The transducer sensed total pressure defect in the wake as well as freestream total pressure on both sides of the sensing element when the probe moved beyond the wake. Profiles of wake total pressure defects plotted as a function of distance above and below the trailing edge plane were averaged for calculating section drag coefficients for flights at low dynamic pressures.
G.G.

N76-11011* Beech Aircraft Corp., Wichita, Kans.
AN APPLICATION OF THE OGEE TIP **c05**
Jerald M. Vogel *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 191-202 refs (For availability see N76-10997 02-01)
CSCL 01C

Wind tunnel tests show that the aerodynamic performance of a rectangular 3-D wing is increased by changing its tip to an ogee shape. Potential gains in both cruise and climb performances

for a modified Beech Baron aircraft indicate that incremental changes in performance are on the order of the data scatter associated with applied flight test techniques. G.G.

N76-11012* Wichita State Univ., Kans.
WING-TIP VANES AS VORTEX ATTENUATION AND INDUCED DRAG REDUCTION DEVICES c05
W. H. Wentz, Jr. and M. G. Nagati *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 203-214 refs (For availability see N76-10997 02-01)
CSCL 01C

Analytical studies have been conducted to examine the feasibility of utilizing wing tip turbines to remove swirl from the wing trailing vortex, and hence reduce the potential for upset of following aircraft. Energy recovery from the turbines is also analyzed. A computer routine has been developed to permit rapid parametric studies of various tip turbine designs. It is shown that the optimum turbine is a non-rotating set of vanes which reduce swirl and recover energy in the form of reduced overall configuration induced drag. A specific case study indicates a 23% reduction in induced drag for a rectangular wing of aspect ratio 5.33, operated at a lift coefficient at 1.0. Author

N76-11013* Kansas Univ., Lawrence.
WING TIP VORTEX DRAG c02
Vincent U. Muirhead *In its* Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 215-233 refs (For availability see N76-10997 02-01)
CSCL 01A

Optimization of L/D through minimizing induced drag through a detailed flow study together with force, pressure and vorticity measurements is considered. Flow visualization with neutral helium bubbles provides an excellent means of observing the effects of configuration changes. Author

N76-11014* Gates Learjet Corp., Denver, Colo.
OVERVIEW OF EXTERNAL NACELLE DRAG AND INTERFERENCE DRAG c02
Ronald D. Neal *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 235-244 refs (For availability see N76-10997 02-01)
CSCL 01A

A historical view of multi-jet engine installations is given that emphasizes integration of the powerplant and the airframe in aircraft design for improved reduction in external nacelle drag and interference drag characteristics. G.G.

N76-11015* AiResearch Mfg. Co., Phoenix, Ariz.
INSTALLATION DRAG CONSIDERATIONS AS RELATED TO TURBOPROP AND TURBOFAN ENGINES c07
G. A. Burnett *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 245-256 (For availability see N76-10997 02-01)
CSCL 21E

Some of the specific areas associated with straight jet and turboprop engine installations are outlined where drag reduction and, thus, improved aircraft system performance is obtained. Specific areas constitute air intake sizing for general aviation aircraft, exhaust duct geometries and cooling system arrangements for propeller powered aircraft. G.G.

N76-11016* North Carolina State Univ., Raleigh.
NACELLE DRAG REDUCTION: AN ANALYTICALLY-GUIDED EXPERIMENTAL PROGRAM c02
Frederick O. Smetana *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 257-261 ref (For availability see N76-10997 02-01)
CSCL 01A

Modifications are proposed to standard estimating procedures, as well as the BODY computer program, which predict that the drag of two nacelles will equal the drag of the fuselage. A preliminary computer analysis that considers increased dimensions for the nacelle forebody so that the noise is relatively less blunt indicates a reduction in form drag much greater than the increase in skin friction drag attributable to increased surface area. G.G.

N76-11017* Mississippi State Univ., State College.
AN EXPLORATORY INVESTIGATION OF THE COOLING DRAG ASSOCIATED WITH GENERAL AVIATION PROPULSIVE SYSTEMS c02
E. J. Cross *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 263-272 (For availability see N76-10997 02-01)
(Grant NsG-1083)
CSCL 01A

A systematic investigation of the drag associated with cooling air flow in contemporary general aviation engine installations is proposed. Theoretical and experimental methods include a state-of-the-art survey, determination of cooling drag by flight tests, and establishment of relative magnitude and components of cooling drag. G.G.

N76-11018* Massachusetts Inst. of Tech., Cambridge.
PROPELLERS OF MINIMUM INDUCED LOSS, AND WATER TUNNEL TESTS OF SUCH A PROPELLER c07
E. E. Larrabee *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 273-293 refs (For availability see N76-10997 02-01)
CSCL 01C

The fundamental vortex theory for a single rotation propeller with a finite number of blades is reviewed. The theory leads to the specification of a radial distribution of bound circulation on each blade for minimum induced loss, analogous to the elliptic spanwise distribution of bound circulation on a wing for minimum induced drag. A propeller designed in accord with this theory has been tested in a water tunnel where it exhibited high efficiency in spite of localized cavitating flow. A knowledge of the flow field for an optimum propeller is of value to the airframe designer seeking to maximize the performance of the airplane-propeller combination. Author

N76-11019* Kansas Univ., Lawrence.
SOME COMMENTS ON TRIM DRAG c02
Jan Roskam *In its* Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 295-305 refs (For availability see N76-10997 02-01)
CSCL 01A

A discussion of data of and methods for predicting trim drag is presented. Specifically the following subjects are discussed: (1) economic impact of trim drag; (2) the trim drag problem in propeller driven airplanes and the effect of propeller and nacelle location; (3) theoretical procedures for predicting trim drag; and (4) research needs in the area of trim drag. Author

N76-11020* Virginia Polytechnic Inst. and State Univ., Blacksburg.
REDUCTION OF TRIMMED DRAG c05
F. H. Lutze, Jr. *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 307-318 refs (For availability see N76-10997 02-01)
CSCL 01C

Methods are reported for reducing the aircraft drag coefficient for a given aircraft lift coefficient, or speed. The emphasis is placed in determining the load distribution between the wing-body combination and the tail which reduces overall drag coefficient. Furthermore, a technique is presented which allows the determination of various aerodynamic and geometric parameters to permit the best location to satisfy inherent stability requirements. Included in the method is the calculation of sensitivity coefficients which indicate the importance of various parameters in achieving specified goals. Preliminary results indicate that such an approach is feasible. Author

N76-11021* Massachusetts Inst. of Tech., Cambridge.
TRIM DRAG IN THE LIGHT OF MUNK'S STAGGER THEOREM c02
E. E. Larrabee *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 319-329 refs (For availability see N76-10997 02-01)
CSCL 01A

Munk's stagger theorem holds that the induced drag of a multiplane is independent of the streamwise position (the stagger) of its lifting elements so long as the gap/span ratios and the

element/element lift ratios are specified. In particular, a monoplane-tailplane or a monoplane-foreplane (canard) arrangement can be regarded as a biplane of zero gap and the trim drag due to tailplane download or foreplane upload can be readily calculated. The trim drag penalty is the same for both configurations. Relations are given for trim drag estimates for various practical arrangements. Author

N76-11022* Beech Aircraft Corp., Wichita, Kans.
COST CONSIDERATION FOR AIRCRAFT CONFIGURATION CHANGES, 1 **c05**
R. R. Tumlinson *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 331-335 (For availability see N76-10997 02-01)
CSCL 01C

The costs of improvements in aircraft drag reduction design changes are outlined in the context of production decisions. A drag reduction design with increased airframe weight requires cost increases for direct labor, overhead and direct expenses, plus general and administrative expenses. G.G.

N76-11023* Kansas Univ., Lawrence.
DRAG OF THE COMPLETE CONFIGURATION AERODYNAMIC CONSIDERATIONS, 2 **c02**
Jan Roskam *In its* Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 337-351 refs (For availability see N76-10997 02-01)
CSCL 01A

A number of drag items are related to the performance of a complete aircraft configuration. First, the effect of fuselage camber, wing and nacelle incidence are discussed from a viewpoint of design decision making. Second, the effect of overall cruise drag on the design gross and empty weight of the airplane is discussed. Examples show that cruise drag can have a very important influence on total airplane weight. Third, the effects of usable cruise lift-to-drag ratio and wing loading are shown to be important. Finally several research needs relating to design of the complete configuration are reviewed. Author

N76-11024* Gates Learjet Corp., Denver, Colo.
LEARJET MODEL 25 DRAG ANALYSIS **c05**
Richard Ross and Ronald D. Neal *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 353-363 (For availability see N76-10997 02-01)
CSCL 01C

Procedures and data for estimating drag were used to calculate the drag characteristics of the Model 25 airplane. Based on cruise flight test data obtained on the Model 25, these methods generally predicted the total drag characteristics within current acceptable and reasonable engineering accuracy. Author

N76-11025* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROBLEMS IN PROPULSION SYSTEM INTEGRATION **c07**
W. Henderson and J. Runckel *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 365-385 refs (For availability see N76-10997 02-01)
CSCL 21E

Jet engine components are considered that influence propulsion system integration on the airframe and related aircraft drag areas. Emphasis is placed on high Mach number inlet geometries, boattailed nozzle configurations, propulsive wing installation, wing surface blowing lift, fuselage mounted nacelles, and thrust reversal. G.G.

N76-11026* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPULSION AIRFRAME INTEGRATION **c05**
D. Mikkelson *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 387-402 (For availability see N76-10997 02-01)
CSCL 01C

Wind tunnel simulation tests are reported that utilize a 20 inch powered nacelle for airframe integration studies. Considered are: effects of boattail positioning, nacelle size, aft fuselage drag, over-the-wing half span model installation, and turboprop and ducted fan configurations. G.G.

N76-11027* Mississippi State Univ., State College.
DETERMINATION OF THE LEVEL FLIGHT PERFORMANCE OF PROPELLER-DRIVEN AIRCRAFT **c05**
E. J. Cross *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 403-407 refs (For availability see N76-10997 02-01)
CSCL 01C

A flight test method to determine the level flight performance of propeller driven aircraft is reported that measures the amount of power it takes to overcome a known increment of added drag to maintain steady state flight conditions to determine overall drag and propeller efficiency of a general aviation aircraft. Author

N76-11028* Purdue Univ., Lafayette, Ind.
POSSIBLE APPLICATIONS OF SOARING TECHNOLOGY TO DRAG REDUCTION IN POWERED GENERAL AVIATION AIRCRAFT **c05**
John H. McMasters and George M. Palmer *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 409-430 refs (For availability see N76-10997 02-01)
CSCL 01C

A brief examination of the performance figures achieved by modern soaring machines and a little reflection on the often huge disparity in L/D values between sailplanes and GA aircraft indicates that careful attention to lessons learned in sailplane design and manufacture hold realistic promise for substantial gains in the aerodynamic efficiency of several GA types. Author

N76-11029* Massachusetts Inst. of Tech., Cambridge.
MINIMUM VERTICAL TAIL DRAG **c02**
E. E. Larrabee *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 43-446 (For availability see N76-10997 02-01)
CSCL 01A

Tail size requirement calculations are presented for a vertical tail performing a coordinated turn reversal at corresponding load requirements with minimum tail drag. G.G.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N76-11030*+ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLOW VISUALIZATION OF VORTEX INTERACTIONS IN MULTIPLE VORTEX WAKES BEHIND AIRCRAFT
D. L. Ciffone and C. Lonzo, Jr. Jun. 1975 60 p refs Original contains color illustrations
(NASA-TM-X-62459; A-6193) Avail: NTIS HC $4.50 CSCL 01A

A flow visualization technique was developed which allows the nature of lift-generated wakes behind aircraft models to be investigated. The technique was applied to models being towed underwater in a ship model basin. Seven different configurations of a small-scale model of a 747 transport aircraft were used to allow observation of typical vortex interactions and merging in multiple vortex wakes. It was established that the motion of the wake vortices is often sensitive to small changes in either wing span loading or model attitude. Landing gear deployement was found to cause a far-field reformation of vorticity behind a model configuration which dissipated concentrated vorticity in the near-field wake. Alleviation of wake vorticity is achievable by configuring the wing span loading to cause the wake vortices to move in paths that result in their interactions and merging. The vortices shed from the horizontal stabilizer always moved down rapidly into the wake and merged with the other vortices, primarily the inboard flap vortices. Author

N76-11031*# Transemantics, Inc., Washington, D.C.
CERTAIN PROBLEMS OF EXPERIMENTAL AERODYNAMICS

S. M. Gorlin, ed. Washington NASA Nov. 1975 122 p refs Transl. into ENGLISH from the book "Nekotoryye voprosy eksperimental'noy aerodinamiki, nauchnyye trudy instituta mekhaniki MGU, no. 24" Moscow, Moscow University Press, 1973 p 1-119
(Contract NASw-2792)
(NASA-TT-F-16565) Avail: NTIS HC $5.50 CSCL 01A

Experimental results of a study of the aerodynamic characteristics at low subsonic velocities of poorly streamlined bodies having different shapes and of the flow past irregularities on the earth's surface are presented. The stress and the forces acting on structures are considered as well as the influence of the shape of certain bodies on the change in flow parameters in their vicinity. Author

N76-11032*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL PERFORMANCE OF CROSS-WIND AXIS TURBINES WITH RESULTS FOR A CATENARY VERTICAL AXIS CONFIGURATION
Ralph J. Muraca, Maria V. Stephens, and J. Ray Dagenhart Oct. 1975 85 p refs
(NASA-TM-X-72662) Avail: NTIS HC $5.00 CSCL 01A

A general analysis capable of predicting performance characteristics of cross-wind axis turbines was developed, including the effects of airfoil geometry, support struts, blade aspect ratio, windmill solidity, blade interference and curved flow. The results were compared with available wind tunnel results for a catenary blade shape. A theoretical performance curve for an aerodynamically efficient straight blade configuration was also presented. In addition, a linearized analytical solution applicable for straight configurations was developed. A listing of the computer program developed for numerical solutions of the general performance equations is included in the appendix. Author

N76-11033*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF A COMPUTER PROGRAM TO OBTAIN ORDINATES FOR NACA 4-DIGIT, 4-DIGIT MODIFIED, 5-DIGIT, AND 16 SERIES AIRFOILS
Charles L. Ladson Nov. 1975 45 p refs
(NASA-TM-X-3284; L-10375) Avail: NTIS HC $4.00 CSCL 01A

A computer program developed to calculate the ordinates and surface slopes of any thickness, symmetrical or cambered NACA airfoil of the 4-digit, 4-digit modified, 5-digit, and 16-series airfoil families is presented. The program produces plots of the airfoil nondimensional ordinates and a punch card output of ordinates in the input format of a readily available program for determining the pressure distributions of arbitrary airfoils in subsonic potential viscous flow. Author

N76-11034*# Boeing Commercial Airplane Co., Seattle, Wash.
TRANSONIC PRESSURE MEASUREMENTS AND COMPARISON OF THEORY TO EXPERIMENT FOR AN ARROW-WING CONFIGURATION. VOLUME 1: EXPERIMENTAL DATA REPORT, BASE CONFIGURATION AND EFFECTS OF WING TWIST AND LEADING-EDGE CONFIGURATION
Marjorie E. Manro, Kenneth J. R. Manning, Thomas H. Hallstaff, and John T. Rogers Oct. 1975 640 p refs
(Contract NAS1-12875)
(NASA-CR-132727; D6-42670-2-Vol-1) Avail: NTIS HC $16.25 CSCL 01A

A wind tunnel test of an arrow-wing-body configuration consisting of flat and twisted wings, as well as a variety of leading- and trailing-edge control surface deflections, was conducted at Mach numbers from 0.4 to 1.1 to provide an experimental pressure data base for comparison with theoretical methods. Theory-to-experiment comparisons of detailed pressure distributions were made using current state-of-the-art attached and separated flow methods. The purpose of these comparisons was to delineate conditions under which these theories are valid for both flat and twisted wings and to explore the use of empirical methods to correct the theoretical methods where theory is deficient. Author

N76-11035*# Boeing Commercial Airplane Co., Seattle, Wash.
TRANSONIC PRESSURE MEASUREMENTS AND COMPARISON OF THEORY TO EXPERIMENT FOR AN ARROW-WING CONFIGURATION. VOLUME 2: EXPERIMENTAL DATA REPORT, EFFECTS OF CONTROL SURFACE DEFLECTION
Marjorie E. Manro, Kenneth J. R. Manning, Thomas H. Hallstaff, and John T. Rogers Oct. 1975 614 p refs
(Contract NAS1-12875)
(NASA-CR-132728; D6-42670-3-Vol-2) Avail: NTIS HC $16.25 CSCL 01A

For abstract, see N76-11034.

N76-11036*# Boeing Commercial Airplane Co., Seattle, Wash.
TRANSONIC PRESSURE MEASUREMENTS AND COMPARISON OF THEORY TO EXPERIMENT FOR AN ARROW-WING CONFIGURATION. VOLUME 3: DATA REPORT, COMPARISON OF ATTACHED FLOW THEORIES TO EXPERIMENT
Marjorie E. Manro, Kenneth J. R. Manning, Thomas H. Hallstaff, and John T. Rogers Oct. 1975 526 p refs
(Contract NAS1-12875)
(NASA-CR-132729; D6-42670-4-Vol-3) Avail: NTIS HC $13.00 CSCL 01A

For abstract, see N76-11034.

N76-11037*# Wichita Univ., Kans. Aeronautical Engineering Dept.
EXPERIMENTAL STUDIES OF FLOW SEPARATION AND STALLING ON TWO-DIMENSIONAL AIRFOILS AT LOW SPEEDS. PHASE 2: STUDIES WITH FOWLER FLAP EXTENDED Semiannual Progress Report, 1 Jun. - 30 Nov. 1975
H. C. Seetharam and W. H. Wentz, Jr. 30 Nov. 1975 20 p refs
(Grant NGR-17-003-021)
(NASA-CR-145741) Avail: NTIS HC $3.50 CSCL 01A

Results were given on experimental studies of flow separation and stalling on a two-dimensional GA(W)-1 17 percent thick airfoil with an extended Fowler flap. Experimental velocity profiles obtained from a five tube probe survey with optimum flap gap and overlap setting (flap at 40 deg) are shown at various stations above, below, and behind the airfoil/flap combination for various angles of attack. The typical zones of steady flow, intermittent turbulence, and large scale turbulence were obtained from a hot wire anemometer survey and are depicted graphically for an angle of attack of 12.5 deg. Local skin friction distributions were obtained and are given for various angles of attack. Computer plots of the boundary layer profiles are shown for the case of the flap at 40 deg. Static pressure contours are also given. A GA(W)-2 section model was fabricated with 30 percent Fowler flaps and with pressure tabs. Y.J.A.

N76-11038*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF THE INCREASE IN VORTEX INDUCED ROLLING MOMENT ASSOCIATED WITH LANDING GEAR WAKE
James C. Patterson and Frank L. Jordan, Jr. Nov. 1975 18 p refs
(NASA-TM-X-72786) Avail: NTIS HC $3.50 CSCL 01A

Flight tests were conducted to verify the results found in ground base facilities of the effect of span lift load variation as well as the vortex attentuation of the high energy jet engine exhaust through proper thrust programming. During these flight tests a large increase in vortex strength was experienced as a result of extending the landing gear. Tests in the Langley Vortex Research Facility indicate that the wake produced by the landing gear may possibly form an aerodynamic endplate or reflection plane at the inboard edge of each inboard flap which increases the effective aspect ratio of the flap and thereby increases the strength of the flap outer edge vortex. Author

N76-11039*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A TECHNIQUE FOR ACCELERATING ITERATIVE CONVERGENCE IN NUMERICAL INTEGRATION, WITH APPLICATION IN TRANSONIC AERODYNAMICS
E. Dale Martin Oct. 1975 19 p refs
(NASA-TM-X-62495) Avail: NTIS HC $3.50 CSCL 01A

A technique is described for the efficient numerical solution of nonlinear partial differential equations by rapid iteration. In particular, a special approach is described for applying the Aitken acceleration formula (a simple Pade approximant) for accelerating the iterative convergence. The method finds the most appropriate successive approximations, which are in a most nearly geometric sequence, for use in the Aitken formula. Simple examples are given to illustrate the use of the method. The method is then applied to the mixed elliptic-hyperbolic problem of steady, inviscid, transonic flow over an airfoil in a subsonic free stream. Author

N76-11040*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
NASA/FRC WAKE TURBULENCE FLIGHT TEST PROGRAM: RIDE QUALITY ASPECTS
David A. Deptula Nov. 1975 36 p refs
(Grant NGR-47-005-181)
(NASA-CR-145700; Memo-403225; ESS-4032-104-75) Avail: NTIS HC $4.00 CSCL 01A

To determine how much the ride quality of the Shuttle Carrier (Boeing 747) Aircraft is affected at various spoiler settings, the PEMS II (Portable Environmental Measuring System) was used to measure onboard motion during a test flight October 15, 1975. The PEMS II measures acceleration in the vertical, transverse and longitudinal directions as well as angular rates of pitch, roll, and yaw. The data acquired by this instrument, combined with an airline passenger comfort model, gives an indication of how passengers would react to the motion induced by flying in a vortex alleviation configuration. Author

N76-11041*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL AERODYNAMICS OF UPPER-SURFACE-BLOWING JET-WING INTERACTION
C. Edward Lan and James F. Campbell Washington Nov. 1975 50 p refs
(NASA-TN-D-7936; L-10037) Avail: NTIS HC $4.00 CSCL 01A

A linear, inviscid subsonic compressible flow theory is formulated to treat the aerodynamic interaction between the wing and an inviscid upper-surface-blowing (USB) thick jet with Mach number nonuniformity. The predicted results show reasonably good agreement with some available lift and induced-drag data. It was also shown that the thin-jet-flap theory is inadequate for the USB configurations with thick jet. Additional theoretical results show that the lift and induced drag were reduced by increasing jet temperature and increased by increasing jet Mach number. Reducing jet aspect ratio, while holding jet area constant, caused reductions in lift, induced drag, and pitching moment at a given angle of attack but with a minimal change in the curve of lift coefficient against induced-drag coefficient. The jet-deflection effect was shown to be beneficial to cruise performance. The aerodynamic center was shifted forward by adding power or jet-deflection angle. Moving the jet away from the wing surface resulted in rapid changes in lift and induced drag. Reducing the wing span of a rectangular wing by half decreased the jet-circulation lift by only 24 percent at a thrust coefficient of 2. Author

N76-11042*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FREE-FLIGHT MODEL INVESTIGATION OF A VERTICAL-ATTITUDE VTOL FIGHTER WITH TWIN VERTICAL TAILS
Sue B. Grafton and Ernie L. Anglin Washington Nov. 1975 29 p refs
(NASA-TN-D-8089; L-10450) Avail: NTIS HC $4.00

Free-flight tests were conducted in the Langley full-scale tunnel to determine the stability and control characteristics of a vertical-attitude VTOL fighter having twin vertical tails and a pivoted fuselage forebody (nose-cockpit) arrangement. The flight tests included hovering flights and transition flights from hover to conventional forward flight. Static force tests were also made to aid in the analysis of the flight tests. The model exhibited satisfactory stability and control characteristics, and the transition from hovering flight to conventional forward flight was relatively smooth and straightforward. Author

N76-11043*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTRODUCTION TO THE AERODYNAMICS OF FLIGHT
Theodore A. Talay Washington 1975 203 p refs
(NASA-SP-367) Avail: NTIS HC $7.75 CSCL 01A

General concepts of the aerodynamics of flight are discussed. Topics considered include: the atmosphere; fluid flow; subsonic flow effects; transonic flow; supersonic flow; aircraft performance; and stability and control. J.M.S.

N76-11044*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW SPEED AERODYNAMIC CHARACTERISTICS OF A TRANSPORT MODEL HAVING 42.33 DEG SWEPT LOW WING WITH SUPERCRITICAL AIRFOIL, DOUBLE-SLOTTED FLAPS, AND T-TAIL OR LOW TAIL
Paul G. Fournier Washington Nov. 1975 94 p refs
(NASA-TM-X-3276; L-9957) Avail: NTIS HC $5.00 CSCL 01A

A low-speed investigation was conducted in the Langley V/STOL tunnel over an angle-of-attack range of approximately 4 deg to 24 deg to determine the static longitudinal stability characteristics and high lift performance of a general research model which represented an advanced subsonic transport configuration. The model had a 42.33 deg swept, aspect ratio 7.05 wing with a supercritical airfoil and high lift system consisting of a leading edge device (slat or Kruger flap) and a double-slotted flap. The flaps were deflected for take off and landing configurations and were not deflected for tests of the clean configuration. The model was tested with the horizontal tail in either a T tail or low tail position. The effects of various arrangements of flowthrough nacelles which represent a three engine configuration (two large wing-mounted nacelles and a vertical tail mounted nacelle) and a four engine configuration (four smaller wing-mounted nacelles) were determined. Author

N76-11045*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A DESIGN METHOD FOR ENTRANCE SECTIONS OF TRANSONIC WIND TUNNELS WITH RECTANGULAR CROSS SECTIONS
L. Lionel and John B. Mcdevitt Sep. 1975 36 p refs
(NASA-TM-X-62490; A-6293) Avail: NTIS HC $4.00 CSCL 14B

A mathematical technique developed to design entrance sections for transonic or high-speed subsonic wind tunnels with rectangular cross sections is discribed. The transition from a circular cross-section setting chamber to a rectangular test section is accomplished smoothly so as not to introduce secondary flows (vortices or boundary-layer separation) into a uniform test stream. The results of static-pressure measurements in the transition region and of static and total-pressure surveys in the test section of a pilot model for a new facility at the Ames Research Center are presented. Author

N76-11046*# Georgia Inst. of Tech., Atlanta.
STUDY OF VISCOUS FLOW ABOUT AIRFOILS BY THE INTEGRO-DIFFERENTIAL METHOD Final Report
James C. Wu and Sarangan Sampath Oct. 1975 61 p refs
(Grant NsG-1004)
(NASA-CR-145693) Avail: NTIS HC $4.50 CSCL 01A

An integro-differential method was used for numerically solving unsteady incompressible viscous flow problems. A computer program was prepared to solve the problem of an impulsively started 9% thick symmetric Joukowski airfoil at an angle of attack of 15 deg and a Reynolds number of 1000. Some of the results obtained for this problem were discussed and compared with related work completed previously. Two numerical procedures were used, an Alternating Direction Implicit (ADI) method and a Successive Line Relaxation (SLR) method. Generally, the ADI solution agrees well with the SLR solution and with previous results are stations away from the trailing edge. At the trailing edge station, the ADI solution differs substantially from previous results, while the vorticity profiles obtained from the SLR method there are in good qualitative agreement with previous results. Y.J.A.

N76-11047*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A SUBVORTEX TECHNIQUE FOR THE CLOSE APPROACH TO A DISCRETIZED VORTEX SHEET

Brian Maskew Sep. 1975 33 p refs

(NASA-TM-X-62487; A-6277) Avail: NTIS HC $4.00 CSCL 01A

The close-approach problem associated with flow calculation methods based on vortex-lattice theory was examined numerically using two-dimensional discretized vortex sheets. The analysis first yields a near-field radius of approximately the distance apart of the vortices in the lattice; only within this distance from the sheet are the errors arising from the discretization significant. Various modifications to the discrete vortices are then considered with the objective of reducing the errors. This leads to a near-field model in which a vortex splits into an increasing number of subvortices as it is approached. The subvortices, whose strengths vary linearly from the vortex position, are evenly distributed along an interpolated curve passing through the basic vortices. This subvortex technique can be extended to the three-dimensional case and is efficient because the number of vortices is effectively increased, but only where and when needed. Author

N76-11048# European Space Agency, Paris (France).

AERODYNAMICS OF AIRFOILS IN TRANSONIC FLOW

Jul. 1975 299 p refs Transl. into ENGLISH of "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 299 p Proc. of DGLR Symp., Goettingen, West Ger., 26-27 Oct. 1972 Original German report available from DFVLR, Porz, West Ger. 44.60 DM

(ESA-TT-175; DLR-Mitt-73-04) Avail: NTIS HC $9.25

Results of investigations into transonic flows around airfoils are presented along with experimental and theoretical investigations of sweptback wings. New methods of calculating shock-free flow around airfoil sections in the transonic range, and a new wind tunnel test section for transonic profiles are discussed. For individual titles, see N76-11049 through N76-11060.

N76-11049 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

COMPARATIVE MEASUREMENTS ON THREE GEOMETRICALLY SIMILAR CALIBRATION MODELS OF A TRANSPORT AIRCRAFT TYPE IN THE TRANSONIC WIND-TUNNEL AT THE AVA, GOETTINGEN

W. Lorenz-Meyer *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 1-27 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 1-31 (For availability see N76-11048 02-02)

(DGLR-Paper-72-122)

Results are presented of 3-component measurements in the transonic wind tunnel at AVA in the Mach-number range Ma = 0.7 to 0.96 on three geometrically similar calibration models of a transport aircraft type (an ONERA project). A detailed description of the experimental conditions is given, and the effects of the Reynolds number and of the accuracy of modelling were investigated. Further, for particular conditions (Mach number and Reynolds number), the results obtained are compared with those measured in the wind tunnels S2MA (Modane-Avrieux) and Sigma 4 (St.Cyr). Author (ESA)

N76-11050 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.

THE CALCULATION OF THE BUFFET BOUNDARY FOR SWEPTBACK WINGS

G. Redeker *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 28-81 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 32-90 (For availability see N76-11048 02-02)

(DGLR-Paper-72-123)

A computational method for determining the buffet boundary of a sweptback wing in the transonic range of velocities is described. Thomas's method for determining the buffet boundary for wings without sweepback or only slightly sweptback is extended to wings with marked sweepback. This is done by considering an infinitely long sheared wing using the Sinnott method for calculating the transonic pressure distributions and an integral method for calculating the 3-dimensional turbulent compressible boundary-layer. Theoretical calculations of the buffet boundary by these methods agree well with the experimental results for sweptback wings. Author (ESA)

N76-11051 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.

THEORETICAL INVESTIGATION OF TRANSITION PHENOMENA IN THE BOUNDARY LAYER ON AN INFINITE SWEPTBACK WING

E. H. Hirschel *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 82-101 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 91-112 (For availability see N76-11048 02-02)

(DGLR-Paper-72-124)

The transition in compressible three-dimensional boundary layers on infinite sweptback wings was investigated by applying stability criteria and transition criteria to numerically calculated boundary layer flows. The inviscid flow fields were found experimentally and represent transonic flows about airfoils with embedded supersonic regions. The different criteria and their application to the boundary-layer flows are discussed. The study was made under variation of the two main parameters: angle of sweepback, and free-stream Reynolds number. Author (ESA)

N76-11052 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

ON THE EFFECT OF A STRAKE ON THE FLOW FIELD OF A DELTA WING (LAMDA EQUALS 2) AT NEAR-SONIC VELOCITIES

W. Stahl *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 102-122 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 113-136 (For availability see N76-11048 02-02)

(DGLR-Paper-72-125)

Experimental investigations were carried out on a delta wing with an aspect ratio lambda = 2, and on a double delta wing derived from it. The flow field on the suction side of the basic delta wing with a sharp leading edge is strongly affected by the leading-edge vortices. A forewing (strake) with large sweepback and sharp edges, attached to the main wing, affects by its leading-edge vortices the flow field over the main wing. The resulting changes in the forces, in the pressure distributions on the suction side, and in the flow field were examined at subsonic, and especially at near-sonic, velocities (Ma = 0.5 to 0.9). The vortex-breadown phenomena occurring at high angles of incidence were investigated for the wing with and without the strake.

Author (ESA)

N76-11053 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

IMPROVEMENT OF MANEUVERABILITY AT HIGH SUBSONIC SPEEDS c08

W. Staudacher *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 123-139 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 137-158 (For availability see N76-11048 02-02)

(DGLR-Paper-72-126)

A number of studies were carried out to improve the maneuverability of combat aircraft. As a geometrically variable configuration, slotted and unslotted flaps were fitted to the leading edge and trailing edge of a pilot model, which was tested in the wind-tunnel up to transonic speeds. As geometrically fixed variants of the plan shape, strakes i.e., modifications of the leading edge which have a large angle of sweepback were attached to the trapezoidally shaped basic wing near the wing root, and were investigated over the whole range of Mach numbers (6-component measurements were taken). By combining various aids to maneuverability, an improvement of 100% in performance in certain flight regions could be obtained as compared with

the basic wing. Strakes were considerably more efficient than flap systems at high angles of attack. Author (ESA)

N76-11054 Technische Hochschule, Darmstadt (West Germany). Inst. fuer Flugtechnik.

SIDE-SLIPPING AIRFOILS IN TRANSONIC FLOW

B. Wagner *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 140-165 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 159-192 (For availability see N76-11048 02-02)
(DGLR-Paper-72-127)

A method was developed which takes into account the vortex sheet leaving the lateral edge of a side-slipping wing. The theory of singular integral equations was used to derive an integral equation for the vorticity of the wing wake. This integral equation is similar to the familiar integral equations for sweptback wings in a symmetrical transonic flow. The method of solution developed can be applied to airfoils with arbitrary camber and twist. The singularities in the vortex distribution at the wing apex and at the start of the wake are discussed. Author (ESA)

N76-11055 Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

THE CALCULATION OF SUPERCRITICAL FLOWS ROUND AIRFOILS BY THE MURMAN-KRUPP DIFFERENCE METHOD

R. Vanino *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 166-187 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 193-223 (For availability see N76-11048 02-02)
(DGLR-Paper-72-128)

The results from the Krupp relaxation method show that this method is a useful tool in the practical design of airfoils. Using a simple scheme of calculation, feasible solutions can be obtained within acceptable times by starting from the undisturbed flow. Examples illustrate the wide applicability of the method, which gives good results for thick airfoils with strong suction peaks, at high angles of attack. Author (ESA)

N76-11056 Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Aachen (West Germany). Inst. fuer Theoretische Gasdynamik.

AN ANALOGUE-ANALYTICAL CONSTRUCTION FOR SUPERCRITICAL FLOWS ROUND AN AIRFOIL

H. Sobieczky et al *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 188-197 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 224-240 (For availability see N76-11048 02-02)
(DGLR-Paper-72-129)

A method is presented for solving a mixed elliptic-hyperbolic differential equation in the particular boundary-value problem of supercritical flow round an airfoil. As an analog of a plane inviscid fluid flow, an electric potential flow is used. From these measurements, the subsonic region of the flow round the airfoil, and a starting point are determined for an analytical calculation of the flow in the supersonic region. With this method both shock-free flows and flows with weak shocks can be determined. Author (ESA)

N76-11057 Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).

RESULTS ON THE USE OF SHOCK-FREE TRANSONIC AIRFOILS FOR TRANSPORT AIRCRAFT

J. Scheerer *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 198-226 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 241-275 (For availability see N76-11048 02-02)
(DGLR-Paper-72-130)

Results concerning the design and calculation of supercritical profiles in order to ascertain the applicability of collisionless transonic profiles for wings of large and medium aspect ratio are discussed. In order to determine whether the aerodynamic properties of these profiles can be applied to wings, test results concerning the design of straight and yawing quasi-two-dimensional wings are presented and discussed. In spite of the fact that the test results are not satisfactory in every respect, the limited use of sweepback theory in the case of supercritical wings is regarded as useful for design purposes. In a comparison with comparable conventional profiles an estimate is made of the separation behavior of supercritical profiles in the low-velocity range (Re equals 10,000,000). In connection with the results and experiences discussed for supercritical profiles a possibility of transonic wing design is indicated and discussed. Author (ESA)

N76-11058 Aeronautical Research Inst. of Sweden, Bromma.

THE PREDICTION OF AIRFOIL DISTRIBUTIONS FOR SUBCRITICAL VISCOUS FLOW AND FOR SUPERCRITICAL INVISCID FLOW

A. Gustavsson *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 227-245 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 276-294 (For availability see N76-11048 02-02)
(DGLR-Paper-72-131)

An approximate method is described for calculating the pressure distribution on a thick cambered airfoil in subcritical viscous flow. The results obtained are compared with recent experimental results for subcritical flow conditions. For supercritical inviscid flow conditions pressure distributions were calculated with two finite difference methods. A comparison is made between the two methods and with recent experimental results.
Author (ESA)

N76-11059 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

TRANSONIC AIRFOIL THEORY: A CRITICAL COMPARISON OF VARIOUS METHODS

A. Eberle et al *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 246-271 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 295-328 (For availability see N76-11048 02-02)
(DGLR-Paper-72-132)

The use of theoretical methods for the design of profiles in the supercritical flow range and the employment of computation procedures for the determination of profile characteristics is discussed. The results obtained with the aid of various methods are compared on the basis of an investigation covering six selected profiles. Suggestions regarding the merits of the individual methods for the selection and definition of supercritical profiles are presented, and a new formulation is provided concerning the design approach for profiles with shockless compressing.
Author (ESA)

N76-11060 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.

THE TRANSONIC TEST-SECTION FOR AIRFOIL MEASUREMENTS IN THE INSTITUTE FOR AERODYNAMICS, BRAUNSCHWEIG **c09**

G. Kausche *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 272-287 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 329-346 (For availability see N76-11048 02-02)
(DGLR-Paper-72-133)

A proposed transonic wind tunnel for profile measurements at fairly high Reynolds numbers is described. A detailed account is given of the present state of development of this tunnel, which is a reconstruction of a formerly existing supersonic wind tunnel. The concept underlying the design of this tunnel is reviewed. Criteria for the design of the tunnel are outlined, and the range of operation of the tunnel is discussed. Author (ESA)

N76-11061# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

TRANSONIC AND SUPERSONIC WIND TUNNEL TESTS ON SLENDER CRUCIFORM WING-BODY-TAIL CONFIGURATIONS IN DIFFERENT PITCH AND ROLL POSITIONS Final Report

S. E. Gudmundson and L. Torngren 1975 198 p refs
(Contracts F-INK-07-12-15; F-INK-82223-72-004)

(FFA-TN-AU-988) Avail: NTIS HC $7.50

Wind-tunnel tests were performed to high angles of attack at 7 different Mach numbers between 0.7 and 3.08 and at 5 different roll angles between 0 deg and 45 deg 5-component measurements were done with 9 different model configurations: a 15 diameter long cylinder body with a 1.5 diameter long ogive nose together with two different cruciform tails, two different cruciform wings alone and in combination with the body, the larger cruciform wings with body and two different tails and the larger wings and tails with the wings mounted three diameters further back on the body. Author (ESA)

N76-11062# European Space Agency, Paris (France).
UNSTEADY AERODYNAMIC PRESSURE ON AN ANNULAR CASCADE IN SUBSONIC FLOW

Pierre Salaun Jul. 1975 74 p refs Transl. into ENGLISH of "Pressions Aerodynamiques Instationnaires sur une Grille Annulaire en Ecoulement Subsonique", ONERA, Paris Report ONERA-P-158, 1974

(ESA-TT-173; ONERA-P-158) Avail: NTIS HC $4.50

A mathematical model symbolizing aerodynamic phenomena is proposed in order to study aeroelastic problems in subsonic compressors. The blades of an isolated row are treated as sections of helicoids placed between two concentric cylinders, so that the row rotates without deflecting the air stream if the blades are not deformed. The linearized equations of the lifting problem are solved by the method of superposition of particular solutions, which provides successively the pressure and the potential due to a pressure doublet distribution over the blades, and the integral equation of the problem. The latter is replaced by a system of linear equations, based on a representation of pressure and angle of attack in series of appropriate functions. The calculation methods are described, and results provided for actual rows. The possibility of blade flutter is discussed. Author (ESA)

N76-11063# European Space Agency, Paris (France).
ON THE LIFTING PROBLEM OF WARPED WINGS IN SUPERSONIC FLOWS

Arabindo Das Jul. 1975 62 p refs Transl. into ENGLISH of "Zum Auftriebsprobl. von Tragfluegeln mit Woelbung u. Verwindung bei Ueberschallstroemung", DFVLR, Brunswick Report DLR-FB-75-10, 1975 Original German report available from DFVLR, Porz, West Ger. 23.80 DM

(ESA-TT-174; DLR-FB-75-10) Avail: NTIS HC $4.50

Lift distributions for minimum pressure drag require wing surfaces possessing both camber and twist. For this direct problem of finding wing forms under prescribed lift distributions, a simple analytical method is presented. The derivations of the approximating formulas follow directly from the general solutions of the perturbation fields in supersonic flow, in which the assumption of moderately slender wings is subsequently introduced. In order to check the applicability of the approximating theory, the aerodynamic characteristics of delta wings with various camber and twist were calculated and compared with the corresponding values obtained from the exact theories for higher order conical flows. As a special case the treatment includes the results for plane wings without warping. The calculations of wing shapes under prescribed lift distributions were performed in an obvious and simple manner. Linear superposition of various basic distributions permits the generation of complex wing forms. Author (ESA)

N76-11064# European Space Agency, Paris (France).
INFLUENCE OF SPLITTER WEDGES ON THE LIFT AND DRAG OF A RECTANGULAR WING WITH A BLUNT TRAILING EDGE

M. Tanner Sep. 1975 51 p refs Transl. into ENGLISH of "Einfluss von Trennkeilen auf den Auftrieb u. Widerstand eines Rechteckfluegels mit stumpfer Hinterkante", DFVLR, Goettingen, West Ger. Report DLR-FB-74-61, Jul. 1974 Original German report available from DFVLR, Porz, West Ger. 16 DM

(ESA-TT-187; DLR-FB-74-61) Avail: NTIS HC $4.50

Lift and drag measurements were performed on a rectangular wing with a blunt trailing edge fitted with various splitter wedges. The Mach number had a value of 0.15 and the Reynolds number a value of 2 million, approximately. The results show that for optimum dimensions of the splitter wedge the base drag practically vanishes. Then the wing with a blunt trailing edge fitted with a splitter wedge has an equally high maximum lift to drag ratio as a conventional wing with a sharp trailing edge. Author (ESA)

N76-11065# European Space Agency, Paris (France).
UNSTEADY PRESSURE MEASUREMENTS ON OSCILLATING WING/BODY COMBINATIONS. COMPARISON BETWEEN THEORY AND EXPERIMENT

H. Triebstein et al Sep. 1975 76 p refs Transl. into ENGLISH of "Instationaere Druckverteilungen an schwingenden schlanken Fluegel-Rumpf-Kombinationen. Vergleich zwischen Theorie u. Messung", DFVLR, Goettingen, West Ger. Report DLR-FB-74-47, 26 Apr. 1974 Original German report available from DFVLR, Porz, West Ger. 24 DM

(ESA-TT-189; DLR-FB-74-47) Avail: NTIS HC $5.00

The results of unsteady pressure measurements performed on harmonically oscillating wing-body-combinations in incompressible flow are discussed. The measurements were made in a subsonic wind tunnel at harmonically pitching oscillations about two different pitching axes and at rolling oscillations about the midchord on two different wing-body models with the aspect ratios lambda = 0.57 and lambda = 1.02. The flow speeds were V = 25 m/s and V = 50 m/s, and the oscillation frequencies were f = 6, 12, 18 and 24 cps. The reduced frequencies ran from 0.7 to 5.8. The results of the measurements were critically compared with corresponding theoretical results of the slender-body theory. Author (ESA)

N76-11066# RCA Corp., Cape Kennedy, Fla.
THEORETICAL DEFINITION OF FAMILY IID BALLOON HULL PROFILE

Terrell H. Yon, Jr. 24 Jan. 1974 21 p

(AD-A011654; RCA/TELTA-TR-74-054) Avail: NTIS CSCL 01/3

This technical report contains the original equations defining the theoretical profile of a Family IID hull. In addition, a program using these equations is included for use on a HP 9100B calculator. These equations are fundamental to the evaluation task now in progress under the Design Verification Program. GRA

N76-11067# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.
HIGH REYNOLDS NUMBER TRANSONIC TESTING Final Report, 30 Jun. 1971 - 30 Jun. 1974

John D. Lee May 1975 44 p

(Contract F33615-71-C-1911; AF Proj. 7065)

(AD-A011983; ARL-75-0112) Avail: NTIS CSCL 20/4

An experimental program was conducted to investigate the feasibility of using a pressurized blowdown wind tunnel to simulate transonic flows at flight Reynolds numbers. A 4 inch by 10 inch channel proved to be capable of supplying essentially two-dimensional flows over airfoil models; flow departure from the two-dimensional approximation occurred when shock waves terminating local flows of Mach number greater than about 1.5 caused separation of the sidewall boundary layers. Simulation of the interaction between the terminal shock wave and the model boundary layer appeared to be adequate. Comparisons with data from a larger wind tunnel indicated little or no interference in the subcritical flow range but a large and unpredictable induced attack angle. GRA

N76-10998* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
GENERAL OVERVIEW OF DRAG

S. A. Anderson *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 11-37 refs (For availability see N76-10997 02-01)

CSCL 01A

N76-10999* North Carolina State Univ., Raleigh.
PROSPECTS AND TIME TABLES FOR ANALYTICAL ESTIMATION OF THE DRAG OF COMPLETE AIRCRAFT CONFIGURATION

Frederick O. Smetana *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 39-41 refs (For availability see N76-10997 02-01)

CSCL 01A

N76-11000* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF DRAG CLEAN-UP TESTS IN NASA LANGLEY FULL-SCALE TUNNEL
Marion O. McKinney *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 43-60 refs (For availability see N76-10997 02-01)
CSCL 01A

N76-11005* Massachusetts Inst. of Tech., Cambridge.
PRESERVATION OF WING LEADING EDGE SUCTION AT THE PLANE OF SYMMETRY AS A FACTOR IN WING-FUSELAGE DESIGN
E. Eugene Larrabee *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 107-115 refs (For availability see N76-10997 02-01)
CSCL 01A

N76-11013* Kansas Univ., Lawrence.
WING TIP VORTEX DRAG
Vincent U. Muirhead *In its* Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 215-233 refs (For availability see N76-10997 02-01)
CSCL 01A

N76-11014* Gates Learjet Corp., Denver, Colo.
OVERVIEW OF EXTERNAL NACELLE DRAG AND INTERFERENCE DRAG
Ronald D. Neal *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 235-244 refs (For availability see N76-10997 02-01)
CSCL 01A

N76-11016* North Carolina State Univ., Raleigh.
NACELLE DRAG REDUCTION: AN ANALYTICALLY-GUIDED EXPERIMENTAL PROGRAM
Frederick O. Smetana *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 257-261 ref (For availability see N76-10997 02-01)
CSCL 01A

N76-11017* Mississippi State Univ., State College.
AN EXPLORATORY INVESTIGATION OF THE COOLING DRAG ASSOCIATED WITH GENERAL AVIATION PROPULSIVE SYSTEMS
E. J. Cross *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 263-272 (For availability see N76-10997 02-01)
(Grant NsG-1083)
CSCL 01A

N76-11019* Kansas Univ., Lawrence.
SOME COMMENTS ON TRIM DRAG
Jan Roskam *In its* Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 295-305 refs (For availability see N76-10997 02-01)
CSCL 01A

N76-11021* Massachusetts Inst. of Tech., Cambridge.
TRIM DRAG IN THE LIGHT OF MUNK'S STAGGER THEOREM
E. E. Larrabee *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 319-329 refs (For availability see N76-10997 02-01)
CSCL 01A

N76-11023* Kansas Univ., Lawrence.
DRAG OF THE COMPLETE CONFIGURATION AERODYNAMIC CONSIDERATIONS, 2
Jan Roskam *In its* Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 337-351 refs (For availability see N76-10997 02-01)
CSCL 01A

N76-11029* Massachusetts Inst. of Tech., Cambridge.
MINIMUM VERTICAL TAIL DRAG
E. E. Larrabee *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 43-446 (For availability see N76-10997 02-01)
CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N76-11068+ Wetenschappelijk en Technisch Documentatie-en Informatiecentrum voor de Krijgsmacht, The Hague (Netherlands). Aircraft Engineering Section.
FLIGHT SAFETY: BIBLIOGRAPHY, 1968 - 1974
B. J. J. Warrink, comp. Jan. 1975 181 p refs Partly in ENGLISH, GERMAN, FRENCH, and DUTCH
(TDCK-65616) Avail: NTIS HC $7.50

The 373 abstracts of articles and reports available at TDCK are presented. Sources of unsafety, i.e. mid-air collisions, meteorological and aerodynamic phenomena, fog, fire, actual accidents, prevention, and survivability, safety and survival equipment are the subjects covered in detail. ESA

N76-11069*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HAZARD CRITERIA FOR WAKE VORTEX ENCOUNTERS
Robert I. Sammonds and Glen W. Stinnett, Jr. Aug. 1975 45 p refs
(NASA-TM-X-62473; A-6232) Avail: NTIS HC $4.00 CSCL 01A

A piloted, motion-base simulation was conducted to evaluate the ability of simulators to produce realistic vortex encounters and to develop criteria to define hazardous encounters. Evaluation of the simulation by pilots experienced in vortex encounters confirmed the capability of the simulator to realistically reproduce wake vortex encounters. A boundary for encounter hazard based on subjective pilot opinion was identified in terms of maximum bank angle. For encounter altitudes from 200 to 500 ft (61.0 to 152.4 m), tentative hazard criteria established for visual flight conditions indicated that the acceptable upset magnitude increased nearly linearly with increasing altitude. The data suggest that the allowable upsets under instrument conditions no greater than 50 percent of that allowable under visual conditions. Author

N76-11070# Naval Postgraduate School, Monterey, Calif.
FUEL CELL PRESSURE LOADING DURING HYDRAULIC RAM M.S. Thesis
John W. Patterson Jun. 1975 62 p refs
(AD-A012411) Avail: NTIS CSCL 01/3

Hydraulic ram is the phenomenon associated with the damage caused by high speed projectile impacts with fuel tanks. It is divided into five phases, entry, shock, drag, cavity and exit. The entry, shock and drag phases were of concern in this study. An analytical solution for the pressures developed in the shock phase was formulated based on bullet impact parameters. Pressures developed in the drag phase were experimentally correlated with theoretical predictions. These pressures were proven to be dependent on front wall wave reflections. GRA

N76-11071# Goodyear Aerospace Corp., Litchfield Park, Ariz.
UH-1 BALLISTIC AND BIRD IMPACT TEST STUDY Final Report, 16 Aug. 1974 - 16 Jan. 1975
Wilson C. McDonald and Richard A. Huyett Apr. 1975 48 p
(Contract DAAG46-75-C-0005)
(AD-A012219; GERA-2075; AMMRC-CTR-75-7) Avail: NTIS CSCL 01/3

This program concerns the ballistic and bird impact testing of UH-1 windshields of three different designs. These designs included an acrylic windshield (which was used as the standard), a monolithic polycarbonate windshield with abrasion coating on both surfaces, and a glass-plastic composite using chemically strengthened glass (Chemcor) as the other glass ply. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N76-11072*# Collins Radio Group, Cedar Rapids, Iowa.
MODIFICATION TO AREA NAVIGATION EQUIPMENT FOR INSTRUMENT TWO-SEGMENT APPROACHES
31 Jul. 1975 196 p
(Contract NAS2-7420)
(NASA-CR-137704) Avail: NTIS HC $7.50 CSCL 17G

A two-segment aircraft landing approach concept utilizing an area random navigation (RNAV) system to execute the two-segment approach and eliminate the requirements for co-located distance measuring equipment (DME) was investigated. This concept permits non-precision approaches to be made to runways not equipped with ILS systems, down to appropriate minima. A hardware and software retrofit kit for the concept was designed, built, and tested on a DC-8-61 aircraft for flight evaluation. A two-segment approach profile and piloting procedure for that aircraft that will provide adequate safety margin under adverse weather, in the presence of system failures, and with the occurrence of an abused approach, was also developed. The two-segment approach procedure and equipment was demonstrated to line pilots under conditions which are representative of those encountered in air carrier service. Y.J.A.

N76-11073# Istituto Universitario Navale, Naples (Italy). Ist. di Astronomia Nautica e Navigazione.
OMEGA FIXING FOR INTEGRATED NAVIGATION SYSTEMS
A. Sposito, V. Nastro, and A. Russo 1974 18 p refs In ITALIAN; ENGLISH summary Presented at the 4th Simp. Intern. sull'Automazione Navale, Genoa, 13-15, Nov. 1974
Avail: NTIS HC $3.50

A research program was carried out to define the use of Omega fixing for the Integrated Navigation System. For this purpose, the Omega system was analyzed for accuracy, and in particular, the actual value of the sky-wave corrections (SWC) against the tabulated values was investigated. An experimental program for determining the diurnal variation of these corrections in the zone of Italian shore stations is discussed. The corrections are compared with the tabulated values for all the coupled operating transmission stations. An onboard Omega receiver was employed for testing the validity area of the correction obtained by the shore stations. The research is of some interest in the Mediterranean Sea, owing to its geographical formation and its situation in the Omega lattice. The main concern is the effect on the SWC of land along the propagation path. Author (ESA)

N76-11074# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
NAVSAT/LORAN-C HYBRID AIRCRAFT NAVIGATION SYSTEM
J. G. Wall, R. H. Bauer, M. O. Marshall, and P. C. Marth Apr. 1975 135 p refs
(Contract N00017-72-C-4401)
(AD-A011827; APL/JHU-TG-1250) Avail: NTIS CSCL 17/7

A hybrid aircraft navigation system has been developed using Loran-C signals for continuous position location information, with periodic position updates from the Navy Navigation Satellite System (NAVSAT) to improve the accuracy of the system. Laboratory tests and flight tests have demonstrated the performance of the NAVSAT/Loran-C hybrid system and have established high confidence levels in its ability to provide accurate position location information, and to obtain in-flight local Loran-C grid calibration. This automatic system uses a Loran-C receiver, a NAVSAT receiver, a small computer, and associated display units to provide real-time readout of latitude and longitude. GRA

N76-11075# Intermetrics, Inc., Cambridge, Mass.
ERROR SOURCE RECOVERY FROM INS TEST FLIGHT DATA Final Technical Report
Peter A. Grundy 14 Jul. 1975 223 p refs
(Contract F29601-75-C-0016)
(AD-A012359; IR-122-1; AFSWC-TR-75-49) Avail: NTIS CSCL 17/7

The CIRIS system at Holloman Air Force Base provides a highly precise reference for the flight testing of navigation systems. This report explores the recovery of the significant sources of error of an inertial navigation system under test through optimal filter techniques, using CIRIS data as reference information. A Kalman filter modelling all the significant sources of error for the test INS and the CIRIS INS and precision ranging system, is executed over a set of selected flight test profiles. The estimation of individual sources of error is shown to be inhibited by correlation of the contributions of error sources to the measured quantities. Highly correlated error sources are then lumped into linear combinations, and the reduced error model Kalman filter is executed over the test profiles. GRA

N76-11076# Office of Telecommunications, Boulder, Colo.
REQUIREMENTS FOR AN AIR-GROUND VHF DATA LINK FOR AIR TRAFFIC CONTROL APPLICATIONS Final Report
John P. Murray and John J. Juroshek Oct. 1974 107 p refs
(Contracts DOT-TSC-RA-74-10; DOT-TSC-RA-74-32)
(COM-75-10788/8; OTR-74-44) Avail: NTIS HC $5.50; HC SOD CSCL 17B

Requirements for a digital data-link to operate in the VHF aeronautical mobile band (108-136 MHz) are defined. Requirements are based on the needs of the Air Traffic Control system (ATC) through 1982. The system described is based on the Universal Data Link specified by the Radio Technical Commission on Aeronautics and on the standard prepared by ARINC. Requirements are based on air traffic forecasts, ATC plans, coverage needs, and capacity estimates based on allowable errors and waiting times. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-11077+ Engineering Sciences Data Unit, London (England).
ESTIMATION OF CRUISE RANGE: PROPELLER-DRIVEN AIRCRAFT
Aug. 1975 18 p refs Sponsored by Roy. Aeronautical Soc.
(ESDU-75018) Copyright. Avail: NTIS HC $146.50

Methods for estimating the cruise air range of propeller-driven aircraft were given. Expressions were also given for the fuel flow consumption, specific air range and endurance. Piston-engined and turbo-prop engined aircraft were discussed. Author

N76-11078*# Lockheed-Georgia Co., Marietta.
HIGH REYNOLDS NUMBER TESTS OF A C-141A AIRCRAFT SEMISPAN MODEL TO INVESTIGATE SHOCK-INDUCED SEPARATION
W. T. Blackerby and J. F. Cahill Washington NASA Oct. 1975 193 p refs
(Contract NAS2-8269)
(NASA-CR-2604) Avail: NTIS HC $7.50 CSCL 01C

Results from a high Reynolds number transonic wind tunnel investigation are presented. Wing chordwise pressure distributions were measured over a matrix of Mach numbers and angles-of-attack for which shock-induced separations are known to exist. The range of Reynolds number covered by these data nearly spanned the gap between previously available wind tunnel and flight test data. The results are compared with both flight and low Reynolds number data, and show that use of the semispan test technique produced good correlation with the prior data at

both ends of the Reynolds number range, but indicated strong sensitivity to details of the test setup. Author

N76-11079*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN, COST, AND ADVANCED TECHNOLOGY APPLICATIONS FOR A MILITARY TRAINER AIRCRAFT
Gary C. Hill and Michael Harper Aug. 1975 36 p refs
(NASA-TM-X-62469) Avail: NTIS HC $4.00 CSCL 01C

The potential impact is examined of advanced aerodynamic and propulsive technologies in terms of operating and acquisition costs on conceptual mission and performance requirements for a future undergraduate jet pilot trainer aircraft. Author

N76-11080# Eidgenossisches Flugzeugwerk, Emmen (Switzerland).
DESCRIPTION OF THE POSSIBILITY TO UTILIZE A ROTATING CYLINDER AS MOUSTACHE
M. Martinaglia 9 Jan. 1973 30 p In GERMAN
(CH-6032-Emmen; FO-1153) Avail: NTIS HC $3.75

A high lift airfoil for the fuselage nose of the Mirage 3 S is developed that reduces starting- and landing-runs. This extra airfoil increases lift by increasing the angle of attack; it is kept relatively small for retraction at high flight velocities. A rotational cyclinder (Magnus effect) is investigated as an alternative to the Moustache effect because of its high C sub A value.
Transl. by G.G.

N76-11081# European Space Agency, Paris (France).
CONTROL CONFIGURED VEHICLES (CCV)
May 1975 128 p refs Transl. into ENGLISH of "Regler-Gestuetzte Flugzeuge (CCV)", DGLR, Cologne Report DLR-Mitt-74-11, 1974 128 p Proc. of Joint Meeting of DGLR Specialist Comm. "Flight Characteristics" and "Flight Control", Hamburg, 18 Oct. 1973 Original German report available from ZLDI, Munich 26.90 DM
(ESA-TT-164; DLR-Mitt-74-11) Avail: NTIS HC $6.00

Requirements and possible solutions for control configured vehicles (CCV) are discussed. A review is given of control technology problems associated with CCV design, and research is reported on two specimen aircraft with regard to artificial stabilization. Requirements for maneuverability and dynamic behavior in longitudinal motion were established. A design for a damper-stabilizer system in an aircraft with an elastic elevator system was investigated for different suboptimal control unit structures with limited recovery capacity. For individual titles, see N76-11082 through N76-11084.

N76-11082 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
CONTROL TECHNOLOGY ASPECTS OF AIRCRAFT WITH ARTIFICIAL STABILITY (CCV) WITH PARTICULAR RESPECT TO HANDLING UNDER MANEUVER LOADING
Wolfgang Kubbat *In* ESA Control Configured Vehicles (CCV) (ESA-TT-164) May 1975 p 7-32 Transl. into ENGLISH from "Regler-gestuetzte Flugzeuge (CCV)", DGLR, Cologne Report DLR-Mitt-74-11, 1974 26 p (For availability see N76-11081 02-05)

Control technology problems with the control configured vehicle (CCV) are reviewed. The proposals discussed include control of unstable aircraft, control of maneuver loading, reduction of gusting, flutter damping, and control valves. In connection with the problem of gusting reduction/maneuver loading control, it is shown that the solution cannot be treated in isolation, and the concept of an integrated total control of the elastic aircraft is deduced. This exercise includes both the control of rigid structural forms (the prevailing task) and the addition of forms of elastic movement. Results are presented for two illustrative aircraft. The growing difficulty of the complexity of signal gain and processing is discussed. Author (ESA)

N76-11083 Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
PARAMETRIC INVESTIGATION OF LONGITUDINAL MOVEMENT OF CCV TRANSPORT AIRCRAFT
Heiko Anders *In* ESA Control Configured Vehicles (CCV) (ESA-TT-164) May 1975 p 57-75 Transl. into ENGLISH from "Regler-gestuetzte Flugzeuge (CCV)", DGLR, Cologne Report DLR-Mitt-74-11, 1974 19 p (For availability see N76-11081 02-05)

Making use of two specimen aircraft (the A-300 B and the CON 30 STOL transport project design), research into the artificial stabilization of these aircraft was carried out. Requirements for maneuverability and dynamic behavior in longitudinal movement were established. These served for control system design and for definition of critical boundaries. Also investigated were the effects of different parameters on the critical boundaries to establish trends for future design work. The specimen aircraft were used to demonstrate how much can be achieved in additional performance by artificial stabilization (useful load, range). It was established that in the transport aircraft investigated, a renunciation of natural stability can lead to an improvement in cost-effectiveness. Author (ESA)

N76-11084 Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
FUNDAMENTAL RESEARCH INTO THE OPTIMAL DESIGN OF A DAMPER-STABILIZER SYSTEM WITH AN ELASTIC ELEVATOR
Gunther Schaenzer *In* ESA Control Configured Vehicles (CCV) (ESA-TT-164) May 1975 p 104-128 refs Transl. into ENGLISH from "Regler-gestuetzte Flugzeuge (CCV)", DGLR, Cologne Report DLR-Mitt-74-11, 1974 25 p (For availability see N76-11081 02-05)

The design of a damper-stabilizer system in an aircraft with an elastic elevator system was investigated for different sub-optimal control unit structures with limited recovery capacity. Probing vertical gusting was used as the exciting factor. Pitch angle speed, flight path speed error, and elevator activity were all taken into consideration in the quadratic quality index. Contrary to expectation, the additional return action of the two elevator variables produces only minor improvement of control quality. Considerable improvements in control quality are achieved via the strong recovery action of the elevator servo-motor sweep speed. The optimal equivalent damping level for the elevator servo-motor amounts to about D = 8 in the specimen aircraft and leads to good control characteristics. In all the control unit structures investigated, the elastic elevator brings a deterioration of control quality by comparison with the rigid elevator.
Author (ESA)

N76-11085# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AIRCRAFT GOUND TEST VALIDATION OF A VARIABLE-RESPONSE LANDING GEAR CONCEPT Final Report, Aug. 1973 - Aug. 1974
Joseph G. Mercer Mar. 1975 65 p refs
(AF Proj. 1369)
(AD-A011657; AFFDL-TR-74-143) Avail: NTIS CSCL 01/3

Taxi tests involving an A-37B aircraft were performed at Wichita Municipal Airport, Kansas. The main landing gear was modified to minimize strut friction and to incorporate a softer pneumatic spring. It was found that elimination of strut friction alone, or elimination of strut friction combined with the use of a softer pneumatic spring could significantly reduce aircraft wing stresses. For the cantilever type strut tested, it was determined that reduction of strut friction should be the primary target in attempting to reduce the transmission of ground loads to the airframe. These tests also verified the ability to test trends in landing gear load transmission characteristics using a landing gear drop tower and a hydraulic vibration machine. GRA

N76-11086# Teledyne Ryan Aeronautical Co., San Diego, Calif.
COMPOSITE MANEUVER AUGMENTATION (COMMA) FOR FIGHTER AIRCRAFT PRELIMINARY DESIGN STUDY
Robert B. Chisman Jan. 1974 311 p refs
(Contract F33657-73-A-0056-0005)
(AD-A011772; TRA-30120-1; AFFDL-TR-73-143) Avail: NTIS CSCL 01/3

The Air Force Flight Dynamics Laboratory plans to test an advanced composite wing with an internally blown jet flap on a low cost, low risk unmanned vehicle. This technical report identifies required modifications to the BQM-34F target vehicle, including the engine and wing interface constraints, to support the flight test program. Emphasis was given to the fuselage structure, elevator control power, bleed air valve and ducting, flight control

system, vehicle electrical system, and the instrumentation and telemetry systems. AFFDL provided the wing definition and jet flap wind tunnel test data. GRA

N76-11087# Goodyear Aerospace Corp., Litchfield Park, Ariz.
WINDOW CONTOURED GLASS/PLASTIC TRANSPARENT ARMOR FOR THE UH-1D HELICOPTER Final Report, 4 Jan. 1973 - 20 Jan. 1975
Wilson C. McDonald and Richard A. Huyett May 1975 82 p
(Contract DAAG46-73-C-0075)
(AD-A012215; GERA-2074; AMMRC-CTR-75-12) Avail: NTIS CSCL 01/3

The objectives of this program relate to the design of a transparent armor installation for the UH-1D helicopter. This effort incorporated for the first time significant amounts of high performance glass/plastic laminate armor in an aircraft. Eight slipsets of armor were produced, one of which was installed and flight tested. Environmental testing was also conducted to define armor performance and characteristics. GRA

N76-11088# Advanced Technology Center, Inc., Dallas, Tex.
DESIGN STUDIES OF TRANSONIC AND STOL AIRFOILS WITH ACTIVE DIFFUSION CONTROL Final Report, 19 Apr. 1973 - 19 Jun. 1974
C. H. Haight, T. D. Reed, and B. T. Morland 19 Jun. 1974 88 p refs
(Contract N00019-73-C-0426)
(AD-A011928; ATC-B-94300/4CR-24) Avail: NTIS CSCL 01/3

Results of parametric design studies are presented for supercritical airfoils which employ active diffusion control. Efforts were concentrated on two basically different airfoil profiles. One type of airfoil has a 6% thickness to chord ratio and employs an antiseparation tailored contour (ATC) located in the forward, lower surface. This type of airfoil is considered to be a promising candidate for improving the transonic performance of combat aircraft. The second type of airfoil is 12% thick and has an ATC within the aft, upper surface. This type of wing section is applicable to transonic transports and is compatible with previous STOL designs which employ ATC's. Theoretical analyses indicate both airfoils have large values of the transonic cruise parameter, good transonic lift characteristics, and, in general, offer improved transonic performance. GRA

N76-11089# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
HELICOPTER MAINTENANCE EFFECTIVENESS ANALYSIS Final Report
Calvin Holbert and Gary Newport May 1975 131 p
(Contract DAAJ02-73-C-0029; DA Proj. 1F1-62205-A-119)
(AD-A012225; USAAMRDL-TR-75-14) Avail: NTIS CSCL 01/3

A study has been made of U.S. Army maintenance operations to determine the significance of repetitive maintenance and incorrect diagnoses in regard to U.S. Army maintenance efficiency. A questionnaire was distributed to Army maintenance personnel to solicit their views on maintenance efficiency. In addition, Army aircraft inspection and maintenance data (DA Form 2408-13 and Operations Reliability Maintainability Engineering Data) were reviewed to quantify the number of repetitive maintenance actions. These data included maintenance personnel and maintenance actions for the UH-1H, Ch-47C, and CH-54B model helicopters. GRA

N76-11090# Raven Industries, Inc., Sioux Falls, S.Dak.
POBAL-S, THE ANALYSIS AND DESIGN OF A HIGH ALTITUDE AIRSHIP Final Report, Oct. 1972 - Mar. 1975
Jack D. Beemer, Roger R. Parsons, Loren L. Rueter, Paul A. Seuferer, and LaDell R. Swiden 15 Feb. 1975 183 p refs
(Contract F19628-73-C-0076; AF Proj. 6665; AF Proj. 6866)
(AD-A012292; R-0275006; AFCRL-TR-75-0120) Avail: NTIS CSCL 01/3

An engineering analysis and development effort has been executed to design a superpressure airship, POBAL-S, capable of station keeping at an altitude of 21 kilometers for a duration of 7 days while supporting a payload weighing 890 newtons and requiring 500 watts of electrical power. A detailed parametric trade-off between various power sources and other design choices was performed. The computer program used to accomplish this analysis is described and many results are presented. Th system concept which resulted was a fuel cell powered, propeller driven airship controlled by an on-board autopilot with basic commands telemetered from a ground control station. Design of the balloon, power train, gimbaled propeller assembly, and electronic/electrical systems is presented. Flight operations for launch and recovery are discussed. GRA

N76-11091# Naval Intelligence Support Center, Washington, D.C. Translation Div.
THE SORMOVICH EXPERIMENTAL AIR CUSHION VEHICLE
A. Zhivotovskii, V. Shenberg, and A. Minchenya 28 May 1975 7 p Transl. into ENGLISH from Rechn. Transp. (USSR), no. 3, 1973 p 53-54
(AD-A012080; NISC-Trans-3677) Avail: NTIS CSCL 13/10

The subject experimental air cushion passenger vehicle is an amphibious craft with a nozzle system for forming the air cushion, a flexible skirt, and location of the engine room, fan, and air propellers in the stern, and delivery of power to all users from a single engine through a system of gears and shafts. GRA

N76-11092# Lockheed-Georgia Co., Marietta.
EVALUATION OF THE FLYING QUALITIES REQUIREMENTS OF MIL-F-8785B ASG USING THE C-5A AIRPLANE Final Report, Sep. 1974 - Mar. 1975
Charles C. Silvers and Clifton C. Withers 20 Mar. 1975 335 p
(Contract F33615-75-C-3012)
(AD-A011728; AFFDL-TR-75-3) Avail: NTIS CSCL 01/2

The study was conducted to validate military specification MIL-F-8785B(ASG), Flying Qualities of Piloted Airplanes, dated 7 August 1969, Interim Amendment-1 (USAF), dated 31 March 1971, by performing a detail comparison of its requirements with the known characteristics of the Lockheed C-5A and pilot comments on them. The comparison was based primarily on existing flight test data supplemented by analytical data as required for this evaluation process. Paragraph by paragraph validations of discrepancies are noted, resolution attempted if necessary, and any recommendations given. In addition, recommendations are made enumerating experimental and analytical investigations beyond the scope of this study which will provide data for further validation and updating of the requirements. GRA

N76-11093# Bell Helicopter Co., Fort Worth, Tex.
AN INVESTIGATION OF HIGH-G MANEUVERS OF THE AH-1G HELICOPTER
James R. VanGaasbeek Apr. 1975 179 p refs
(Contract DAAJ02-73-C-0092; DA Proj. 1F1-62208-AA-43)
(AD-A012234; USAAMRDL-TR-75-18) Avail: NTIS CSCL 01/2

The high-g maneuver capabilities of the AH-1G have been investigated in this effort. Flight test data for 132 high-g maneuvers have been studied and statistically analyzed to determine the relationships among the variables. A series of fixed-collective symmetric pullups was simulated, using the Rotorcraft Flight Simulation Program C81, to determine the mechanisms limiting high-g maneuvers of the AH-1G. Statistical analysis of the C81 data was used to supplement the analysis of the test data. Three additional maneuvers, similar to the most severe test maneuvers, were simulated. GRA

N76-11094# Boeing Vertol Co., Philadelphia, Pa.
ENGINE/TRANSMISSION/AIRFRAME ADVANCED INTEGRATION TECHNIQUES Final Technical Report
Theodore Himka and Richard D. Semple May 1975 172 p refs
(Contract DAAJ02-74-C-0043; DA Proj. 1G2-62207-AH-89)
(AD-A012236; D210-10900-1; USAAMRDL-TR-75-16) Avail: NTIS CSCL 01/3

Innovative engine/transmission/airframe integrated design concepts were developed to provide total airflow and power management for a utility transport helicopter which meets projected requirements of future Army aircraft. These requirements include engine compartment cooling, drive train and transmission oil cooling, engine oil cooling, exhaust plume and hot metal

infrared (IR) signature suppression, and engine inlet foreign particle protection. GRA

N76-11095# Hughes Helicopters, Culver City, Calif.
PRODUCIBILITY AND SERVICEABILITY OF KEVLAR-49 STRUCTURES MADE ON HOT LAYUP TOOLS Final Report, 31 May 1974 - 30 Apr. 1975
B. Head, J. Leach, R. Goodall, and C. Sitterly May 1975 114 p refs
(Contract DAAG46-74-C-0100)
(AD-A012265; AMMRC-CTR-75-10) Avail: NTIS CSCL 11/4

The purposes of the program were: evaluate the producibility of a helicopter structural component made from Kevlar-49 fibers, demonstrate the low cost aspects of using hot layup tools to fabricate composite structures, and evaluate the serviceability of the Kevlar-49 structure in actual field operations. GRA

N76-11001* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMPLIFIED THEORETICAL METHODS FOR AERODYNAMIC DESIGN
Jan R. Tulinius *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 61-76 refs (For availability see N76-10997 02-01)
CSCL 01C

N76-11002* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DRAG REDUCTION: BACK TO BASICS
Oran W. Nicks *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 77-85 refs (For availability see N76-10997 02-01)
CSCL 01C

N76-11003* Kansas Univ., Lawrence.
SOME COMMENTS ON FUSELAGE DRAG
Jan Roskam *In its* Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 87-102 refs (For availability see N76-10997 02-01)
CSCL 01A

N76-11004* Beech Aircraft Corp., Wichita, Kans.
PROPELLER BLOCKAGE RESEARCH NEEDS
R. R. Tumlinson *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 103-105 refs (For availability see N76-10997 02-01)
CSCL 01C

N76-11007* Gates Learjet Corp., Denver, Colo.
THE ECONOMIC IMPACT OF DRAG IN GENERAL AVIATION
Ron D. Neal *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 125-135 refs (For availability see N76-10997 02-01)
CSCL 01C

N76-11008* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME METHODS FOR REDUCING WING DRAG AND WING-NACELLE INTERFERENCE
Thomas C. Kelly *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 137-156 refs (For availability see N76-10997 02-01)
CSCL 01C

N76-11009* Kansas Univ., Lawrence.
DRAG REDUCTION THROUGH HIGHER WING LOADING
David L. Kohlman *In its* Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 157-169 refs (For availability see N76-10997 02-01)
CSCL 01C

N76-11011* Beech Aircraft Corp., Wichita, Kans.
AN APPLICATION OF THE OGEE TIP
Jerald M. Vogel *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 191-202 refs (For availability see N76-10997 02-01)
CSCL 01C

N76-11012* Wichita State Univ., Kans.
WING-TIP VANES AS VORTEX ATTENUATION AND INDUCED DRAG REDUCTION DEVICES
W. H. Wentz, Jr. and M. G. Nagati *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 203-214 refs (For availability see N76-10997 02-01)
CSCL 01C

N76-11020* Virginia Polytechnic Inst. and State Univ., Blacksburg.
REDUCTION OF TRIMMED DRAG
F. H. Lutze, Jr. *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 307-318 refs (For availability see N76-10997 02-01)
CSCL 01C

N76-11022* Beech Aircraft Corp., Wichita, Kans.
COST CONSIDERATION FOR AIRCRAFT CONFIGURATION CHANGES, 1
R. R. Tumlinson *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 331-335 (For availability see N76-10997 02-01)
CSCL 01C

N76-11024* Gates Learjet Corp., Denver, Colo.
LEARJET MODEL 25 DRAG ANALYSIS
Richard Ross and Ronald D. Neal *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 353-363 (For availability see N76-10997 02-01)
CSCL 01C

N76-11026* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPULSION AIRFRAME INTEGRATION
D. Mikkelson *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 387-402 (For availability see N76-10997 02-01)
CSCL 01C

N76-11027* Mississippi State Univ., State College.
DETERMINATION OF THE LEVEL FLIGHT PERFORMANCE OF PROPELLER-DRIVEN AIRCRAFT
E. J. Cross *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 403-407 refs (For availability see N76-10997 02-01)
CSCL 01C

N76-11028* Purdue Univ., Lafayette, Ind.
POSSIBLE APPLICATIONS OF SOARING TECHNOLOGY TO DRAG REDUCTION IN POWERED GENERAL AVIATION AIRCRAFT
John H. McMasters and George M. Palmer *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 409-430 refs (For availability see N76-10997 02-01)
CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N76-11010* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
USE OF A PITOT PROBE FOR DETERMINING WING SECTION DRAG IN FLIGHT
Edwin J. Saltzman *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 171-189 ref (For availability see N76-10997 02-01)
CSCL 01D

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-11096*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SOME EFFECTS OF THE ATMOSPHERE AND MICROPHONE PLACEMENT ON AIRCRAFT FLYOVER NOISE MEASUREMENTS

Robert N. Hosier (Army Air Mobility R and D Lab., Hampton, Va.) and David A. Hilton Nov. 1975 15 p refs Presented at the 90th Meeting of the Acoust. Soc. of Am., San Francisco, 4-7 Nov. 1975

(NASA-TM-X-72791) Avail: NTIS HC $3.50 CSCL 20A

The effects of varying atmospheric conditions on certification-type noise measurements were studied. Tests were made under various atmospheric conditions at two test sites, Fresno, California, and Yuma, Arizona, using the same test aircraft, noise, and weather measuring equipment, and operating personnel. Measurements were made to determine the effects of the atmosphere and of microphone placement on aircraft flyover noise. The measurements were obtained for characterization of not only the acoustic signature of the test aircraft, but also specific atmospheric characteristics. Data are presented in the form of charts and tables which indicate that for a wide range of weather conditions, at both site locations, noise data were repeatable for similar aircraft operating conditions. The placement of microphones at ground level and at 1.2 m over both spaded sand and concrete illustrate the effects of ground reflections and surface impedance on the noise measurements. Author

N76-11097*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DUCT LINER OPTIMIZATION FOR TURBOMACHINERY NOISE SOURCES

Harold C. Lester and Joe W. Posey Nov. 1975 20 p refs Presented at 90th Meeting of the Acoust. Soc. of Am., San Francisco, 4-7 Nov. 1975

(NASA-TM-X-72789) Avail: NTIS HC $3.50 CSCL 21E

An acoustical field theory for axisymmetric, multisectioned lined ducts with uniform flow profiles was combined with a numerical minimization algorithm to predict optimal liner configurations having one, two, and three sections. Source models studied include a point source located on the axis of the duct and rotor/outlet-stator viscous wake interaction effects for a typical research compressor operating at an axial flow Mach number of about 0.4. For this latter source, optimal liners for equipartition-of energy, zero-phase, and least-attenuated-mode source variations were also calculated and compared with exact results. It is found that the potential benefits of liner segmentation for the attenuation of turbomachinery noise is greater than would be predicted from point source results. Furthermore, effective liner design requires precise knowledge of the circumferential and radial modal distributions. Author

N76-11098*# Solar, San Diego, Calif.

ADVANCED LOW NO SUB x COMBUSTORS FOR SUPERSONIC HIGH-ALTITUDE AIRCRAFT GAS TURBINES Report for Mar. 1974 - Jun. 1975

P. B. Roberts, D. J. White, and J. R. Shekleton Nov. 1975 81 p refs

(Contract NAS3-18028)

(NASA-CR-134889; RDR-1814) Avail: NTIS HC $5.00 CSCL 21E

A test rig program was conducted with the objective of evaluating and minimizing the exhaust emissions, in particular NO sub x, of three advanced aircraft combustor concepts at a simulated, high altitude cruise condition. The three combustor designs, all members of the lean reaction, premixed family, are the Jet Induced Circulation (JIC) combustor, the Vortex Air Blast (VAB) combustor, and a catalytic combustor. They were rig tested in the form of reverse flow can combustors in the 0.127 m. (5.0 in.) size range. Various configuration modifications were applied to each of the initial JIC and VAB combustor model designs in an effort to reduce the emissions levels. The VAB combustor demonstrated a NO sub x level of 1.1 gm NO2/kg fuel with essentially 100% combustion efficiency at the simulated cruise combustor condition of 50.7 N/sq cm (5 atm), 833 K (1500 R) inlet pressure and temperature respectively and 1778 K (3200 R) outlet temperature on Jet-A1 fuel. Early tests on the catalytic combustor were unsuccessful due to a catalyst deposition problem and were discontinued in favor of the JIC and VAB tests. In addition emissions data were obtained on the JIC and VAB combustors at low combustor inlet pressure and temperatures that indicate the potential performance at engine off-design conditions. Author

N76-11099*# Naval Air Propulsion Test Center, Trenton, N.J.

ROTOR BURST PROTECTION PROGRAM: STATISTICS ON AIRCRAFT GAS TURBINE ENGINE ROTOR FAILURES THAT OCCURRED IN US COMMERCIAL AVIATION DURING 1973 Final Report, 1972 - 1973

R. A. DeLucia and G. J. Mangano Aug. 1975 28 p

(NASA Order C-41581-B)

(NASA-CR-134854; NAPTC-PE-61) Avail: NTIS HC $3.75 CSCL 21E

Statistical data on gas turbine rotor failures that have occurred in U.S. commercial aviation during 1973 was presented. Analysis of the data led to the following conclusions: (1) the incidence of rotor failure and uncontained burst is significantly high enough to warrant continuation of the efforts of the Rotor Burst Protection Program (RBPP), (2) of all the types of fragments generated, disk fragments, because of their size, high energy content and high rate of uncontainment (100 %), continue to be a major threat to the welfare and safety of commercial aircraft passengers, (3) the number of uncontained blade failures is surprisingly high since rotor blade containment is required for engine certification under FAA regulations, (4) it appears that causes beyond the control or scope of pressent technology are still primarily responsible for most of the rotor failures that occur. Y.J.A.

N76-11100*# Transemantics, Inc., Washington, D.C.

THE PROBLEM OF FLOW MIXING IN A DOUBLE-FLOW ENGINE

Barbara Jung Washington NASA Nov. 1975 20 p refs Transl. into ENGLISH from Technika Lotnicza i Astronautyczna (Poland), v. 22, Aug. 1967 p 5-10

(Contract NASw-2792)

(NASA-TT-F-16648) Avail: NTIS HC $3.50 CSCL 21E

The problem of mixing gas flow from the main channel and air flow from the outer channel of a double-flow engine was discussed. Methods of designing the mixing chambers to achieve a constant cross-section and a constant pressure in the range of subsonic velocities for both flows were presented, and the usefulness of flow mixing was justified. Some typical construction designs for mixing chambers were described. Author

N76-11101# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

MEASUREMENT OF VELOCITY DISTRIBUTION AT THE IMPELLER EXIT OF A RADIAL COMPRESSOR

D. Olivari and A. Salaspini Mar. 1975 66 p refs

(VKI-TN-106) Avail: NTIS HC $4.50

The flow field at the exit of the impeller of a low speed radial compressor was investigated in detail to analyze the velocity distribution over one blade pitch. The research was aimed at mapping the jet and wake configurations at different flow rates, and at different rotational speeds. For this purpose, spanwise traverses were carried out at two circumferential angles. Furthermore, an attempt was made to measure the two components of the turbulent fluctuation parallel and normal to the absolute velocity in the jet and in the wake. All the measurements were performed by means of a hot wire anemometer. The data analysis was performed by means of an analog conditional sampler which made possible the actual measurement of the blade-to-blade velocity distribution. Results confirm the theoretical prediction that if a jet and wake configuration occurs, a low value of the slip factor is obtained

on the blade pressure side where the jet is developing.
Author (ESA)

N76-11102# Pratt and Whitney Aircraft, East Hartford, Conn.
INFLUENCE OF TURBINE ENGINE LUBRICANT LOAD CARRYING ABILITY ON GEAR SYSTEM DESIGN Final Report, 4 Mar. - 15 Aug. 1974
F. C. Hsing and W. J. Walker Sep. 1974 58 p refs
(Contract F33615-74-C-2021; AF Proj. 3048)
(AD-A011656; PWA-5090; AFAPL-TR-74-94) Avail: NTIS CSCL 11/8

The objective of this study was to evaluate the effect of lubricant load-carrying ability on the design of gear systems in aircraft turbine engine accessory and main power transmission gearboxes. Five gearbox designs, representing a wide range of applications and power levels, were analyzed to assess any payoff, in terms of weight reduction and life cycle operating cost, which may be possible through the use of lubricants possessing increased load-carrying ability. The designs included a modern transport engine, JT9D-7, accessory gearbox; a current fighter engine, TF30-P-100, accessory gearbox; a turboprop, T34, main power transmission gearbox; a proposed turbofan, QCSEE, main power transmission gearbox reflecting advanced technology and a helicopter, CH53, gearbox. GRA

N76-11103# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF A ROTATING CYLINDER DEPOSITION TEST Interim Report, 1 Feb. 1972 - 31 Mar. 1975
J. P. Cuellar and B. B. Baber Jun. 1975 65 p refs
(Contract F33615-72-C-1097; AF Proj. 3048)
(AD-A012298; SwRI-RS-629; AFAPL-TR-75-37) Avail: NTIS CSCL 11/8

A rotating cylinder deposition test for the evaluation of aircraft turbine engine lubricants was investigated. The device was selected for study on the basis of its promise for achieving controlled or measurable lubricant films and oxidative exposure conditions. Evaluation tests with this configuration were performed with four coded lubricants. Performance criteria in these tests included deposit rating, viscosity and neutralization number change, and oxygen consumption. Test conditions selected for this series of runs results in severe fluid deterioration for all but one lubricant. GRA

N76-11104# Naval Academy, Annapolis, Md. Div. of Engineering and Weapons.
THE EFFECT OF RESISTORS AND PARTIAL ENCLOSURES ON THE ATTACHMENT CHARACTERISTICS OF A COANDA SURFACE Final Technical Report
Vincent J. Lopardo 1 May 1975 20 p
(AD-A012370; EW-5-75) Avail: NTIS CSCL 20/4

This paper reports on the results of an experimental program which investigated the effects of various parameters on the attachment characteristics of flow over a Coanda surface. The parameters studied were (a) resistance elements at the exhaust region normal to the surface, (b) normal knife edge extension into the jet flow at the entrance of the Coanda surface, and (c) combination effect of a backwall and resistance element. The results are presented in the form of graphs, which can be interpreted to give the relative reductions in attachment. GRA

N76-11247 Advisory Group for Aerospace Research and Development, Paris (France).
CONSTITUTION OF THE ATMOSPHERE IN THE GAS TURBINE
In its High Temperature Corrosion of Aerospace Alloys Aug. 1975 p 37-39 (For availability see N76-11244 02-23)

N76-11015* AiResearch Mfg. Co., Phoenix, Ariz.
INSTALLATION DRAG CONSIDERATIONS AS RELATED TO TURBOPROP AND TURBOFAN ENGINES
G. A. Burnett *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 245-256 (For availability see N76-10997 02-01)
CSCL 21E

N76-11018* Massachusetts Inst. of Tech., Cambridge.
PROPELLERS OF MINIMUM INDUCED LOSS, AND WATER TUNNEL TESTS OF SUCH A PROPELLER
E. E. Larrabee *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 273-293 refs (For availability see N76-10997 02-01)
CSCL 01C

N76-11025* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROBLEMS IN PROPULSION SYSTEM INTEGRATION
W. Henderson and J. Runckel *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 365-385 refs (For availability see N76-10997 02-01)
CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-11105*# National Aeronautics and Space Administration, Washington, D.C.
FLIGHT-DETERMINED STABILITY AND CONTROL DERIVATIVES FOR AN EXECUTIVE JET TRANSPORT
Harriet J. Smith Jul. 1975 46 p refs
(NASA-TM-X-56034; H-901) Avail: NTIS HC $4.00 CSCL 01C

A modified maximum likelihood estimation (MMLE) technique which included a provision for including a priori information about unknown parameters was used to determine the aerodynamic derivatives of the Lockheed JetStar airplane. Two hundred sixty-five maneuvers were performed with the JetStar airplane, which was modified to include direct lift controls, to obtain lateral-directional and longitudinal derivatives. Data were obtained at altitudes of 3048 meters, 6096 meters, and 9144 meters (10,000 feet, 20,000 feet, and 30,000 feet) and over an angle of attack range from approximately 3 deg to 13 deg and a Mach number range from 0.25 to 0.75. Side force generators were installed and tested in 87 maneuvers to determine their effectiveness and their effect on the other derivatives. Lateral-directional data for four flight conditions were analyzed without using a priori information to assess the effect of this feature on the results. The MMLE method generally gave consistent (repeatable) estimates of the derivatives, with the exception of the rolling moment due to yaw rate, which showed large variances. Author

N76-11106# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
DEVELOPMENT OF A HYDROFLUIDIC STABILIZATION AUGMENTATION SYSTEM HYSAS FOR AN AX CLASS AIRCRAFT Final Report, Dec. 1972 - Nov. 1974
Holger C. Kent Jan. 1975 177 p
(Contract F33615-73-C-3068)
(AD-A011727; Honeywell-W-3068; AFFDL-TR-74-147) Avail: NTIS CSCL 01/3

This program consisted of the design, development, fabrication, and evaluation of a Hydrofluidic Yaw Axis Stability Augmentation System (HYSAS). The objective was to develop a low cost, reliable, lightweight, flightworthy HYSAS with moderate performance and low-field maintenance characteristics compared to an electro-hydraulic SAS for jet powered AX class tactical aircraft. A system analysis was conducted that included a computer simulation of the Fairchild Aircraft Co. A-10 aircraft. From the results of the computer simulation, a yaw damper configuration was determined that improved flying quality characteristics by increasing dutch roll damping throughout the flight envelope of the AX Class Tactical Aircraft (AXCTA). GRA

N76-11107# Bell Helicopter Co., Fort Worth, Tex.
FLIGHT CONTROL SYSTEM RELIABILITY AND MAINTAINABILITY INVESTIGATIONS Final Report
John Zipperer, Gavin Jenney, and Jerry Bryant Mar. 1975 294 p refs
(Contract DAAJ02-73-C-0026; DA Proj. 1F1-62203-A-119)
(AD-A012233; USAAMRDL-TR-74-57-FR) Avail: NTIS CSCL 01/3

Army helicopter nonrotating flight control system specifications, standards, and design handbooks were reviewed for areas in which improvements could be made to requirements affecting system and mission reliability and maintainability. R and M requirements were essentially missing from all documents reviewed, and therefore specific requirements were added for reliability, maintainability, and supporting workmanship, qualification, and production acceptance. Special emphasis was directed toward requiring those distributional material properties, failure and maintenance time data, and analytical methods which permit Design for Reliability (Probabilistic Design) and Maintainability directly into components and thus into the flight control system. GRA

N76-11053 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
IMPROVEMENT OF MANEUVERABILITY AT HIGH SUBSONIC SPEEDS
W. Staudacher *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 123-139 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 137-158 (For availability see N76-11048 02-02)
(DGLR-Paper-72-126)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N76-11108# National Aeronautical Lab., Bangalore (India). Instrumentation Div.
A MULTIPOINT EXCITATION SYSTEM FOR GROUND RESONANCE TESTING OF AIRCRAFT
R. Viswanathan and M. R. Ramamurthy Apr. 1974 36 p refs
(NAL-TN-46) Avail: NTIS HC $4.00

A multipoint excitation system for resonance testing of complex structures is described. The system can be used to power up to 6 shakers of 20 Kg. force capacity, over a frequency range of 5 Hz to 500 Hz. Two sets of power amplifiers, one for low level, and one for high level drive, form the basic source of drive power for the shakers. Control equipment consists of preamplifiers and phase shifters for each of 6 channels; measuring equipment include a vibration meter and force measuring unit. The control and measuring equipment are all housed in a mobile console which contains all the operating controls for the system. Author

N76-11109*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
MODELLING ATMOSPHERIC TURBULENCE FOR A MOTION-BASED SIMULATOR Status Report
Ira D. Jacobson and Dinesh Joshi Oct. 1975 53 p refs
(Grant NGR-47-005-028)
(NASA-CR-145745; ESS-4035-104-75) Avail: NTIS HC $4.50 CSCL 14B

The background information in establishing several proposed atmospheric turbulence models for use on motion based aircraft simulators was documented. A specific model was proposed which, in addition to varying turbulence intensity (rms velocity), varies the atmospheric turbulence scale length to achieve compatibility with real atmospheric turbulence. With a suitable combination of scale length and intensity distribution, the model will simulate various atmospheric conditions characterized by altitude, stability, and terrain. The model is mechanized to be included in a flight simulator experiment in order to determine to what extent the pilots are sensitive to changes in atmospheric conditions and the realism of the model. The following topics were covered: literature survey, presently used techniques, proposed model, and simulation details. Author

N76-11110# Advisory Group for Aerospace Research and Development, Paris (France).
A FURTHER REVIEW OF CURRENT RESEARCH AIMED AT THE DESIGN AND OPERATION OF LARGE WIND TUNNELS
Sep. 1975 130 p refs
(AGARD-AR-83) Avail: NTIS HC $6.00

Work completed previously describing projected areas considered to be relevant to the design and operation of large wind tunnels was reviewed in the light of progress made. Comments and recommendations are made. In each one of the four fields of work selected, two conveners, one from each side of the Atlantic, brought together the foremost workers in that field to discuss what needs to be done, how the work should proceed, and how it could be shared. Altogether 132 research workers from nine countries participated and made valuable contributions. Topics of importance, including some which require particular attention, were also identified and divided into three categories: problems for which sufficient effort is currently being devoted, problems not currently attracting enough attention but where some activities are expected soon, and problems where positive action is necessary. Author

N76-11111*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF SLOT WIDTH ON TRANSITION AND NOISE ATTENUATION OF A FLAT SOUND SHIELD IN A MACH 6 WIND TUNNEL
P. Calvin Stainback, William D. Harvey, and Andrew J. Srokowski Washington Nov. 1975 52 p refs
(NASA-TN-D-8081; L-10403) Avail: NTIS HC $4.50 CSCL 14B

An experimental and theoretical study of a sound shield concept to attenuate the noise radiated into the test section from the turbulent boundary layer on the walls of wind tunnels was conducted. The model investigated was planar with a sharp flat plate leading edge faired into an array of rods aligned nearly parallel to the local flow. For a ratio of gap diameter to rod diameter of 0.16, the flow was laminar over the entire model at a maximum local length Reynolds number of 14 million. A 45% reduction in the tunnel free stream root mean square pressure level was measured within the shielded region for this gap width when the boundary layers on the rods were laminar. Smaller ratios of gap diameter to rod diameter resulted in substantial reductions in the transition Reynolds number, and in a 40% pressure reduction. Author

N76-11112# Eidgenossisches Flugzeugwerk, Emmen (Switzerland).
THE MIRROR IMAGE METHOD FOR CALCULATING WIND TUNNEL CORRECTIONS
U. Schleicher 2 Apr. 1974 26 p refs In GERMAN
(CH-6032-Emmen; FO-1218) Avail: NTIS HC $3.75

The mirror image method is used in blockage correction calculations on wind tunnels. Detailed instructions are provided for various mirror image arrangements in rectangular wind tunnels with emphasis on displacement- and uplift-problems. Mirror image positioning in both cases includes ground effect and half model measurements. Transl. by G.G.

N76-11113*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EIGHTH CONFERENCE OF SPACE SIMULATION
Washington 1975 859 p refs Conf. held at Silver Spring, Md., 3-5 Nov. 1975; sponsored by Inst. of Environ. Sci., AIAA, ASTM, and NASA
(NASA-SP-379) Avail: NTIS HC $21.25 CSCL 14B

Papers are presented on the state-of-the-art in space simulation, spacecraft contamination, thermal control systems, biosciences, and flammability. For individual titles, see N76-11114 through N76-11180.

N76-11114* Aerojet Electrosystems Co., Azusa, Calif.
AESC MULTINODAL FREE MOLECULAR CONTAMINATION TRANSPORT MODEL
E. A. Zeiner *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 1-31 refs (For availability see N76-11113 02-09)
(Paper-1) CSCL 14B

The film formation effects are examined of self-induced clouds and condensed films of volatile condensible materials (VCMs) which outgas from such sources as paints, coatings, adhesives, and other nonmetallic surfaces of satellites. A semi-empirical theory for the multiple scattering of free neutral molecules from dielectric surfaces which includes the effects of condensation and evaporation is defined and a mathematical model of the process is developed. The formation rate of thin surface films is considered to be the net accumulation of two simultaneous molecular processes; emission (evaporation) and adsorption (condensation). The net formation rate is considered to be dependent upon the temperature of the surface nodes, the mass and temperatures of the gas molecules, and the total pressure of the incident molecular flux. Apparatus and procedures for measuring these parameters are presented. Author

N76-11115* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT RECONTAMINATION
J. Barengoltz and D. Edgars (Bionetic Corp.) *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 33-50 refs (For availability see N76-11113 02-09)
(Contract NAS7-100)
(Paper-2) CSCL 14B

A computer simulation program to model the redistribution of particulate contaminants on a spacecraft after launch was developed. The component models for particulate adhesion, meteoroid impact, and electrostatic forces are described and intermediate results are presented. The results of a sample calculation show that the recontamination process is important. Author

N76-11116* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
HELIOS SURFACE MATERIALS, TEST-PREDICTIONS AND TEST-RESULTS OF ORBIT CONDITIONS COMPARED WITH MISSION RESULTS
W. Winkler *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 51-62 refs (For availability see N76-11113 02-09)
(Paper-3) CSCL 14B

The severe HELIOS mission environment asked for an appropriate material selection for optical surfaces based on a good approach to predict degradation and contamination effects by analysis and an adequate vertification by test. Analysis results are compared with flight data of the HELIOS-A mission. Author

N76-11117* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CORRELATION OF AN OPTICAL SYSTEM DEGRADATION WITH CONTAMINATION ON A CRITICAL SURFACE
J. J. Scialdone *In its* 8th Conf. on Space Simulation 1975 p 63-72 refs (For availability see N76-11113 02-09)
(Paper-4) CSCL 14B

The loss of sensitivity of a radiantly cooled radiometer during space operation was investigated. A quartz crystal microbalance (QCM), mounted in the proximity of the instrument filter lens and held at its temperature, measured the contaminant at the location during a vacuum test. The temperature cycling of the lens and the QCM verified the contamination of the lens as the cause of the deterioration. Data on the instrument performance in space and in the chamber allowed estimation of the rate of contaminant accretion on the lens in space service. That rate was used to estimate the contaminant partial pressure. The nature of material was inferred by comparison of the partial pressures and the saturated vapor pressures of materials at the temperature of the contaminated surface. These data, in conjunction with data on fields of view of the lens, are used to identify the sources of contamination. Author

N76-11118* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA FROM A SYNCHRONOUS ALTITUDE SATELLITE QUARTZ CRYSTAL MICROBALANCE MONITOR
John F. Rogers *In its* 8th Conf. on Space Simulation 1975 p 73-88 refs (For availability see N76-11113 02-09)
(Paper-5) CSCL 14B

Results of one year's operation in orbit of the Quartz Crystal Microbalance Monitor on the ATS-6 satellite are presented. The data indicate a general decreasing trend for the first four and one-half months in orbit. At that time, a sudden increase in beat frequency occurred; this correlates in time with the firing of the North Cesium Ion Engine. A general increase in beat frequency is evidenced since that time. Laboratory tests conducted to investigate the phenomenon are described. Author

N76-11119* Aerospace Corp., El Segundo, Calif.
EXPERIMENT TO MEASURE ENHANCEMENT OF SPACECRAFT CONTAMINATION BY SPACECRAFT CHARGING
David F. Hall, E. N. Borson, R. A. Winn (AFML), and W. L. Lehn (AFML) *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 89-107 refs (For availability see N76-11113 02-09)
(Paper-6) CSCL 14B

An ambitious effort to measure contamination on a highly instrumental spacecraft is being carried out. Spacecraft contamination enhancement by spacecraft charging is described. A brief summary of the motivation for and the capabilities of the Spacecraft Charging at High Altitudes (SCATHA) Spacecraft is given. The experimental approach is described and summaries are given of previous spaceflight experiments in which similar instrumentation has been used. A description of the experimental flight hardware planned for SCATHA is included. Author

N76-11120* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SKYLAB PARASOL MATERIAL EVALUATION
Stephen Jacobs and Thomas J. Ballentine *In its* 8th Conf. on Space Simulation 1975 p 109-123 (For availability see N76-11113 02-09)
(Paper-7) CSCL 14B

Results of experimental work to evaluate the degradation rate of a parasol that was used to alleviate thermal problems encountered soon after the launch of the Skylab 1 space vehicle are presented. Author

N76-11121* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
DEVELOPMENT OF A THERMAL PREDICTION MODEL AND FLIGHT DATA EVALUATION AND COMPARISON FOR THE EOB EXPERIMENT OF THE HELIOS SOLAR PROBE
K. Kramp, W. Ley, and H. P. Schmidt *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 125-132 refs (For availability see N76-11113 02-09)
(Paper-8) CSCL 14B

A thermal model for the EOB experiment has been developed, adopted to test data, and used to predict flight temperatures. These predictions are compared to flight data covering the period from launch until the first black-out. Author

N76-11122* Gesellschaft fuer Weltraumforschung m.b.H., Porz (West Germany).
LAY OUT, TEST VERIFICATION AND IN ORBIT PERFORMANCE OF HELIOS A TEMPERATURE CONTROL SYSTEM
W. Brungs *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 133-135 (For availability see N76-11113 02-09)
(Paper-9) CSCL 14B

HELIOS temperature control system is described. The main design features and the impact of interactions between experiment, spacecraft system, and temperature control system requirements on the design are discussed. The major limitations of the thermal design regarding a closer sun approach are given and related to test experience and performance data obtained in orbit. Finally the validity of the test results achieved with prototype and flight spacecraft is evaluated by comparison between test data, orbit temperature predictions and flight data. Author

N76-11123* Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
ANALYSIS OF THE RESPONSE OF A BIMETAL ACTUATED THERMAL CONTROL LOUVER SYSTEM BY COMPUTER SIMULATION
R. Mancuso and P. Hrycak (New Jersey Inst. of Tech.) *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 137-151 refs (For availability see N76-11113 02-09)
(Paper-10) CSCL 14B

The performance characteristics of a bimetallic coil actuated thermal control louver system were simulated using a multinode mathematical computer model. There is satisfactory agreement between space chamber data and calculations by the methods discussed. Author

N76-11124* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DOSIMETRY OF LOW ENERGY PROTON BEAMS FOR USE IN SPACECRAFT PARTS TESTING
Charles G. Miller *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 153-154 (For availability see N76-11113 02-09)
(Paper-11) CSCL 14B

Thermoluminescent Dosime tes (TLD) were used to measure proton fluences consisting of 5MeV or lower energies. The results were at variance with the corresponding gamma measurements. The results of experiments on low energy proton dosimetry using LiF-in-teflon microrods (TLD-700 or LiF-7), are presented. Author

N76-11125* Boeing Co., Seattle, Wash.
THERMAL SCALE MODELING OF A MANNED SPACECRAFT
Roger L. Shannon and Ronald C. Zentner *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 155-157 (For availability see N76-11113 02-09)
(Contract NAS9-8332)
(Paper-12) CSCL 14B

A manned spacecraft thermal scale modeling program is described. The program consisted of the design, construction, instrumentation, testing, data correlation, and associated analysis of a transient thermal scale model (TSM) of the Subsystem Test Bed (STB). The STB was chosen as a representative manned spacecraft for which detailed thermal vacuum test data were available. The STB is a cylindrical vehicle (15 ft diameter by 8.3 ft high) with four docking hatches and six windows. The pressure shell is insulated with multilayer insulation and protected by meteoroid shields. Four truss assemblies were used to support the STB during testing. It was concluded that thermal scale modeling can be used as an effective thermal design/verification tool for manned spacecraft. Thermal analysis can be used in conjunction with scale model testing to provide a verified math model that can be applied to the prototype manned spacecraft. Author

N76-11126* Air Force Materials Lab., Wright-Patterson AFB, Ohio. Space and Missiles Branch.
THERMOSTRUCTURAL TESTING OF INSTRUMENTED ATJ-S GRAPHITE NOSETIP MODELS IN THE AFFDL 50 MW RENT FACILITY
Charles L. Budde *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 159-160 (For availability see N76-11113 02-09)
(Paper-13) CSCL 14B

Instrumented ATJ-S graphite shell nosetip models were tested in the AFFDL 50 MW RENT Facility. The inside surface of the models were instrumented with seven thermocouples and three clip-on extensometers. One thermocouple was located at the inside stagnation point and three thermocouples were located at 120 degree intervals on the aft portion of the skirt of the model. In addition, three thermocouples at 120 degree intervals plus three clip-on extensometers at 120 degree intervals offset 60 degrees from the thermocouples were located in the critical region. The outside surface temperature of the models was monitored in two locations by optical pyrometers. Finally, the tests were recorded by three high speed motion picture cameras. Pressure models and calorimeters were also tested in order to help define the flow field condition and heating distribution around the models. Author

N76-11127* Air Force Materials Lab., Wright-Patterson AFB, Ohio. Space and Missiles Branch.
THERMOSTRUCTURAL TEST FACILITIES FOR REENTRY VEHICLE NOSE TIP MATERIALS
Charles L. Budde *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 161-162 (For availability see N76-11113 02-09)
(Paper-14) CSCL 14B

To provide a cost effective means of assessing the thermostructural performance of nosetip materials, the Air Force has developed and utilized two types of thermostructural facilities: ground simulation facilities and laboratory facilities. The capabilities of the currently available test facilities are summarized and compared. Author

N76-11128* Air Force Materials Lab., Wright-Patterson AFB, Ohio.
A METHOD FOR THE EVALUATION OF DAMAGE ON THE SURFACE OF CARBON-CARBON ABLATION SAMPLES
E. W. Heinonen and G. Y. Jumper, Jr. *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 163-174 refs (For availability see N76-11113 02-09)
(Paper-15) CSCL 14B

The effect of weave geometry on the onset of transition from laminar to turbulent flow around a sample of an orthogonally woven fine weave carbon-carbon material tested in an arc-jet is investigated. Seventeen post-test models which had undergone only partial transition around the circumference were examined as to location of turbulent regions relative to the weave axes. It was statistically shown that the weave axes had the lowest probability of being a position of initial transition onset. The probability generally increased with distance from a major axis, with some rays, notably the 45 deg rays, showing better transition resistance than the adjacent rays. The incidence of initial transition onset correlated well with the number of X or Y fibers that the flow passes over from stagnation point to the shoulder. Author

N76-11129* McDonnell Aircraft Co., St. Louis, Mo.
LARGE MODULAR GRAPHITE RADIANT HEATERS FOR TESTING SPACE SHUTTLE THERMAL PROTECTION SYSTEMS
B. G. Cox and H. E. Christensen *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 175-186 (For availability see N76-11113 02-09)
(Paper-16) CSCL 14B

A graphite radiant heating array, capable of heating a 5-ft span of shuttle wing leading edge or a 4 x 8 ft flat panel through an entry thermal profile up to 3200 G, has been designed and built by McDonnell Douglas Corporation for NASA-Johnson Space Center. The unique, interchangeable, self-contained heather modules and their versatile support structure/coolant manifold are discussed along with the extensive thermal analysis that accompanied the design effort. A complete description of the geometric capabilities of the array, as well as the design details of the individual modules, is presented. The complete performance envelope of the array is discussed, including maximum temperature and gradients, heating uniformity, and the required utilities and support equipment. Author

N76-11130* Aerospace Corp., El Segundo, Calif.
PROPERTIES OF CONDUCTIVE COATINGS FOR THERMAL CONTROL MIRRORS AND SOLAR CELL COVERS
D. E. Joslin and H. K. A. Kan *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 187-193 refs (For availability see N76-11113 02-09)
(Paper-17) CSCL 14B

Conductive transparent coatings applied to the dielectric surfaces of a spacecraft offer the possibility of distributing charge uniformly over the entire spacecraft surface. Optical and electrical measurements of such a coating as a function of temperature are described. These results are used in considering the impact of a conductive coating on the absorptance of thermal control mirrors and on the transmittance of solar cell cover glass, which can be improved by the application of an antireflection coating. Author

N76-11131* Rockwell International Corp., Downey, Calif. Space Div.
AN EXPERIMENTAL SUMMARY OF PLASMA ARC EXPOSURES OF SPACE SHUTTLE HIGH-TEMPERATURE REUSABLE SURFACE INSULATION TILE ARRAY WITH A SINGLE MISSING TILE (CONDUCTED AT THE AMES RESEARCH CENTER)
S. A. Galanter *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 195-207 (For availability

see N76-11113 02-09)
(Paper-18) CSCL 14B

A space shuttle high temperature reusable surface insulation (HRSI) tile array with a single missing or lost tile was exposed to a hot gas simulated reentry environment to investigate the heating conditions in and around the vicinity of the missing HRSI tile. Heat flux and pressure data for the lost tile condition were obtained by the use of a water cooled lost tile calibration model. The maximum aluminum substrate temperature obtained during the simulated reentry was 128 C (263 F). The lost tile calibration data indicated a maximum heat flux in the lost tile cavity region of 63 percent of the upstream reference value. This test was conducted at the Ames Research Center in the 20 MW semielliptical thermal protection system (TPS) pilot plasma arc test facility. Author

N76-11132* McDonnell-Douglas Astronautics Co., St. Louis, Mo.

A NEW ARC HEATER SHROUD TEST TECHNIQUE FOR THERMO-STRUCTURAL TESTING OF FULL-SCALE, NOSE-TIP SKIRT MATERIALS

R. R. Williams, J. W. Stultz, and R. J. Popp *In* NASA. Goddard Space Flight Center. 8th Conf. on Space Simulation 1975 p 209-221 refs (For availability see N76-11113 02-09)
(Paper-19) CSCL 14B

An arc heater shroud test technique was developed for thermostructural testing of full-scale, missile nose tip-skirt assemblies. Reentry trajectory simulation is provided by changing the arc heater operation in a prescribed manner through manual and automatic controls. Excellent test repeatability allows screening of materials by direct comparison of test results. Continuous recordings of model surface temperature, pressure, heat flux, and model internal temperatures are made at several locations during the test. Author

N76-11133* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

SPIN TEST ON HELIOS LOUVER

F. Joo *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 223-231 (For availability see N76-11113 02-09)
(Paper-20) CSCL 14B

The effect of the spin motion of the solar probe on the characteristic of the louver was investigated. The qualification test set-up and procedure is described along with tests results. Author

N76-11134* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

SPECIAL PROBLEMS OF THE THERMAL SIMULATION OF HELIOS EXPERIMENT E6: TEST RESULTS COMPARED WITH FLIGHT DATA

W. Hallmann, W. Ley, and H. P. Schmidt *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 233-242 refs (For availability see N76-11113 02-09)
(Paper-21) CSCL 14B

The maximum solar energy (16 Solar Constants) irradiating experiment orifice E6 intermittently during the mission of space probe HELIOS has been reproduced in a High Intensity Component Test Facility. A detailed comparison is given between test results and flight data evaluation. Author

N76-11135* Messerschmitt-Boelkow G.m.b.H., Ottobrunn (West Germany).

HELIOS MISSION: CRITICAL ASSESSMENT OF GROUND TEST RESULTS VERSUS ACTUAL ORBIT PERFORMANCE

H. C. Benoehr and H. W. Prem *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 243-258 refs (For availability see N76-11113 02-09)
(Paper-22) CSCL 14B

Results of ground tests on the Helios spacecraft are correlated to orbit performance of Helios A. In-orbit failures and corrective actions for Helios B are summarized. Author

N76-11136* Boeing Aerospace Co., Seattle, Wash.

COMBINED ENVIRONMENTAL EFFECTS ON POLYMERS

Lawrence B. Fogdall and Sheridan S. Cannaday *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 259-260 (For availability see N76-11113 02-09)
(Contract NAS1-13530)
(Paper-23) CSCL 14B

A series of space simulation tests on FEP Teflon and other polymeric thermal control coatings was conducted using UV, electrons, protons and Lyman-alpha wavelength vacuum UV radiation. Interest was centered on simulating synchronous altitude radiation environment conditions. Physical changes in materials included loss of specularity and introduction of a high density of photographable tracking defects on a microscopic scale. An example shows the discharge of trapped electrons when dielectric strength is exceeded. This leaves a portion of the Teflon volume no longer clear, but diffusely transmitting and reflecting. Thermophysical changes included degradation of solar absorptance coefficients as much as five-fold. The situation that prevails for earth orbit contrasted with polymer performance in the solar wind. It is suggested that conductive overcoatings be developed for polymers and other flexible materials, comparable or superior to those available for fused silica SSMs. Author

N76-11137* Communications Research Centre, Ottawa (Ontario).

FUNCTIONAL AND DYNAMICS TESTING OF THE FLEXIBLE SOLAR ARRAY FOR THE COMMUNICATIONS TECHNOLOGY SATELLITE

T. D. Harrison, R. Buckingham, and F. R. Vigneron *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 261-277 refs (For availability see N76-11113 02-09)
(Paper-24) CSCL 14B

The test objectives, test methods, thermal environmental simulations, and test results are described, for a series of combined dynamic, thermal, and vacuum environmental tests on a Deployable Solar Array for the Communications Technology Satellite. Six major resonant structural modes were observed over an excitation range of 0.1-1.0 Hz. Corresponding modal damping factors were found to be between 0.001 and 0.01. Variation of temperature environments between -125 C and 42 C did not significantly affect the characteristics of the fundamental modes, but did influence some of the higher modes. Superharmonic response behavior was observed. The tests also verified functional mechanical performance of the solar array under thermal and vacuum conditions. Author

N76-11138* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

PRELIMINARY EVALUATION OF THE CONTAMINANT INDUCED ENVIRONMENT FOR THE SPACE SHUTTLE ORBITER

L. E. Bareiss (Martin Marietta Corp., Denver), R. O. Rantanen (Martin Marietta Corp., Denver), E. B. Ress (Martin Marietta Corp., Denver), and L. J. Leger *In its* 8th Conf. on Space Simulation 1975 p 279-304 refs (For availability see N76-11113 02-09)
(Contract NAS9-14212)
(Paper-25) CSCL 14B

A preliminary evaluation of the on-orbit induced environment from identified major sources of contamination for the STS shuttle orbiter is presented. A contamination computer mathematical model is discussed that was used to develop the description and predictions of the induced environment along with the extent and physical makeup of the molecular induced environment from these sources. The predicted induced molecular environment from each source is evaluated against current Space Shuttle Program on-orbit contamination control criteria. The flash evaporator vents and the VCS 25-lb thrust engines are shown to significantly exceed applicable contamination control criteria and were the subject of extensive evaluation. Preliminary conclusions concerning the contaminant potential of these sources along with recommendations for various measures of contamination control regarding the shuttle orbiter design and operational activities are made. Author

N76-11139* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A RADIOMETER FOR MONITORING COLUMN DENSITIES OF INFRARED-ACTIVE MOLECULES

F. C. Witteborn, J. P. Simpson, L. S. Young, C. D. Swift, and R. K. Melugin *In its* 8th Conf. on Space Simulation 1975

p 307-320 refs (For availability see N76-11113 02-09)
(Paper-27) CSCL 14B

A cryogenically cooled radiometer capable of accurately measuring the infrared background from 3.5 to 100 microns and the column density of water vapor for the low values specified for the space shuttle orbiter is described. The infrared spectral characteristics of the contaminant atmosphere are considered as well as the spectral characteristics of the natural IR background. The measurement technique is described in detail. J.M.S.

N76-11140* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE OUTGASSING RATE FOR A SHUTTLE THERMAL PROTECTIVE SURFACE USING RTV 560 ADHESIVE
D. W. Jex and E. L. Shriver *In its* 8th Conf. on Space Simulation 1975 p 321-341 ref (For availability see N76-11113 02-09)
(Paper-28) CSCL 14B

An experimental program was conducted to identify the outgassing rate for a shuttle baseline thermal protective surface (TPS) which utilizes room temperature volcanizing (RTV) 560 adhesive. Results are discussed. Author

N76-11141* Faraday Labs., Inc., La Jolla, Calif.
CRYOGENIC QUARTZ CRYSTAL MICROBALANCE
D. McKeown, G. Sonnenschein, and M. G. Fox *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 343-353 refs (For availability see N76-11113 02-09)
(Contract NAS8-31110)
(Paper-29) CSCL 14B

A radiatively cooled Cryogenic Quartz Crystal Microbalance designed to monitor highly volatile contaminants on the shuttle is described. Measurements are made with two 15-MHz microbalances having removable, optically polished sensors mounted in a radiant cooler. One sensor operates below the freezing point of water and monitors contamination including that of water vapor. The second sensor is heated and monitors the contamination background. It provides a reference from which the density of the water vapor cloud enveloping the shuttle is determined. The design incorporates a low-power dissipation oscillator, heaters for ice removal, and a method for attaching second-surface mirrors to the radiator employing an indium type solder instead of a room temperature vulcanizer. Author

N76-11142* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ANALYSIS OF RADIATIVE SOURCES WITH BOTH SPECULAR AND DIFFUSE CHARACTERISTICS IN THE VISIBLE AND INFRARED SPECTRUM
Franklin U. Williams *In its* 8th Conf. on Space Simulation 1975 p 355-369 (For availability see N76-11113 02-09)
(Paper-30) CSCL 14B

The application of analytical concepts developed to facilitate the design and analysis of the thermal simulator for the Apollo Soyuz docking module is discussed. The functions used to mathematically formulate the irradiance from a quartzline lamp and reflector are described with examples of applications to other geometries. General information is denoted for utilization of the functions in computer programs with approximate computer storage and statement requirements. Author

N76-11143* Stanford Univ., Palo Alto, Calif.
SATELLITE THERMAL MODELING USING THE ILLUMINOGRAPHIC CAMERA
S. J. Wiesner, B. Howland (MIT), and D. M. Nathanson (MIT) *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 371-385 refs Sponsored by AF (For availability see N76-11113 02-09)
(Paper-31) CSCL 14B

The application is discussed of illuminographic camera techniques to the measurement of radiative form factors for satellite modeling applications. The equation for the illuminographic mirror is derived, and the advantages of the method are discussed. Proximity error for the illuminographic mirror is defined, and estimates of this error as a function of the scale factor of the model are given, together with a method for halving this error. Designs for illuminographic mirrors are presented: the first provides a further threefold reduction in proximity error; the second permits the estimation of thermal radiation transfer coefficients to interior regions of otherwise inaccessible volumes. Finally, reflex Polaroid camera techniques appropriate to the relatively small size of the illuminographic mirror are described. Author

N76-11144* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
THE USE OF SOLAR SIMULATION SYSTEMS FOR PRODUCING ARTIFICIAL GLOBAL RADIATION FOR THE PURPOSE OF DETERMINING THE HEAT LOAD OF ROOMS
A. C. Kalt *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 387-400 refs (For availability see N76-11113 02-09)
(Paper-32) CSCL 14B

Certain climatic tests which require solar and sky radiation were carried out in the laboratory by using simulated global radiation. The advantages of such a method of measurement and the possibilities and limitations resulting from the simulation of global radiation are described. Experiments concerning the thermal load in rooms were conducted in order to test the procedure. In particular, the heat gain through a window with sunshade is discussed, a venetian blind between the panes of a double-glazed window being used in most cases. Author

N76-11145* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH ENERGY SOLAR BEAM TESTING IN THE JPL 25-FT SPACE SIMULATOR
J. W. Harrell *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 401-407 ref (For availability see N76-11113 02-09)
(Paper-33) CSCL 14B

Modifications to the individual components in the solar simulation system to improve performance and reduce costs are described. The improvements include: an increase in lamp power from 20 KW to 30 KW; a family of solar beams from 8 to 18.5 feet in diameter at intensities related to beam size with a maximum intensity of 12 solar constants over a 9 ft. diameter; and up to 1.1 megawatts of simulated solar energy in the lamp array. Author

N76-11146* Martin Marietta Aerospace, Denver, Colo.
PERFORMANCE AND OPERATING CHARACTERISTICS OF A 4.88-M DIAMETER SOLAR SIMULATOR FOR VIKING SPACE SIMULATION TESTS
R. P. Parrish, Jr. *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 409-417 refs (For availability see N76-11113 02-09)
(Paper-34) CSCL 14B

The solar simulator met the solar radiation requirements of the two and a half year Viking test program, but not without some interesting problems and experiences. Operating characteristics of the simulator, the system maintenance program, and the test program are described. Author

N76-11147* Martin Marietta Aerospace, Denver, Colo.
SPECIAL TECHNIQUES OF THE VIKING LANDER CAPSULE THERMAL VACUUM TEST PROGRAM
Tibor Buna *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 419-433 refs (For availability see N76-11113 02-09)
(Contract NAS1-9000)
(Paper-35) CSCL 14B

Techniques employed to reduce chamber time and improve data capabilities on the Viking Lander Capsule thermal test program are described. Author

N76-11148* Space Science and Technology Centre, Trivandrum (India). Vikram Sarabhai Space Centre.
THERMOELASTIC ANALYSIS OF SOLAR WINDOW OF A VACUUM CHAMBER
C. L. Amba-Rao and S. R. Soni *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 435-448 refs (For availability see N76-11113 02-09)
(Paper-36) CSCL 14B

It has been noted during space simulation test programs that the chamber penetration window becomes the limiting factor as the solar intensity increases. The temperature at the center of the window normally attains a level of 550 C, while the

edge temperature remains at about 35 C. The stresses produced by this thermal gradient combined with the atmospheric pressure are studied within the framework of classical theory of elasticity. The solution for the problem is obtained by solving the static uncoupled thermoelastic equations for a circular blank, subjected to nonuniform heat on one face, by introduction of two auxiliary variables. The displacements are expressed in terms of Bessel functions and parameters of interest are computed at various mesh points of the window. The maximum principal stresses thus obtained show that even with steep temperature gradient, the safety factor is acceptable. Author

N76-11149* General Electric Co., Philadelphia, Pa.
TRANSPORT OF LIQUID STATE NITROGEN THROUGH LONG LENGTH SERVICE LINES DURING THERMAL/VACUUM TESTING
F. A. Florio *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 449-468 refs (For availability see N76-11113 02-09)
(Paper-37) CSCL 14B

Physical and analytical aspects associated with the transport are presented. Included is a definition of the problems and difficulties imposed by the servicing of a typical solid cryogen system, as well as a discussion of the transport requirements and of the rationale which governed their solution. A successful detailed transport configuration is defined, and the application of established mathematics to the design approach is demonstrated. The significance of head pressure, pressure drop, line friction, heat leak, Reynolds number, and the fundamental equilibrium demands of pressure and temperature were examined as they relate to the achievement of liquid state flow. Performance predictions were made for the transport system, and several analytical quantities are tabulated. These data are analyzed and compared with measured and calculated results obtained while actually servicing a solid cryogen system during thermal/vacuum testing. Author

N76-11150* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LEAK RATE MEASUREMENTS FOR SATELLITE SUBSYSTEMS AND RESIDUAL GAS ANALYSIS DURING SPACE ENVIRONMENT TESTS
H. Nuss (Industrieanlagen-Betriebsgesellschaft m.b.H.) *In its* 8th Conf. on Space Simulation 1975 p 469-485 refs (For availability see N76-11113 02-09)
(Paper-38) CSCL 14B

The measuring and evaluation procedure for the determination of leak rates of satellite subsystems with a quadrupole mass spectrometer, and the results of the residual gas analysis are described. The method selected for leak rate determination was placing the system into a vacuum chamber and furnishing the chamber with a mass spectrometer and calibrated leaks. The residual gas of a thermal vacuum test facility, in which the thermal balance test radiation input was simulated by a heated canister, was analyzed with the mass spectrometer in the atomic mass unit range up to 300 amu. In addition to the measurements during the space environment tests, mass spectrometric studies were performed with samples of spacecraft materials. The studies were carried out during tests for the projects HELIOS, AEROS B and SYMPHONIE. Author

N76-11151* Space Science and Technology Centre, Trivandrum (India).
THE THERMAL SYSTEM FOR AN ENVIRONMENTAL CHAMBER
K. Srinivasan, K. Badari Narayana (Indian Inst. of Tech.), S. Srinivasa Murthy (Indian Inst. of Tech.), and M. V. Krishna Murthy (Indian Inst. of Tech.) *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 487-493 refs (For availability see N76-11113 02-09)
(Paper-39) CSCL 14B

The design of a cooling and heating system for obtaining temperatures in the range of -60 C to +120 C on a thermal shroud is described. The proposed temperature control uses mechanical refrigeration with Freon-22 as the primary refrigerant, methanol as the secondary coolant for low temperatures, and electrically heated ethylene glycol for high temperatures. The system is designed to give the following time-temperature characteristics: lowering the temperature from +30 C to -60 C in 1.5 hours; maintaining the temperature at -60 C for a period of 6 hours; heating from -60 C to +120 C in 3 hours; maintaining the temperature at +120 C for a period of 6 hours; and cooling from +120 C in 1.5 hours. A description of the system and its operation are given. Author

N76-11152* Space Science and Technology Centre, Trivandrum (India). Vikram Sarabhai Space Centre.
VACUUM CONSIDERATIONS IN THE DESIGN OF A SPACE SIMULATOR
S. Ramachandran *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 495-504 refs (For availability see N76-11113 02-09)
(Paper-40) CSCL 14B

Vacuum considerations in the techniques for design, fabrication, and testing of space simulators are discussed. Particular emphasis is given to a diffusion pump-rotary pump combination for the vacuum system. M.J.S.

N76-11153* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FACILITY AND TEST SUPPORT EQUIPMENT FOR THE MANNED THERMAL VACUUM TESTS OF THE APOLLO SOYUZ DOCKING MODULE
O. L. Pearson *In its* 8th Conf. on Space Simulation 1975 p 505-532 refs (For availability see N76-11113 02-09)
(Paper-41) CSCL 14B

In order to accommodate manned thermal-vacuum testing of the Apollo-Soyuz docking module (ASDM), modifications to the facility, cleanliness and access control, and special test equipment were required. Facility modifications discussed briefly include: the addition of an oxygen supply system; the modification of manlock (ML) piping for cleaning and access controls; the addition of a nitrogen diluent system; the removal of manlock internal lights and the addition of external lights as well as fusing all power circuits over 10 watts; the removal/containment of flammable materials; the upgrading of a ML fire suppression system; and the addition of a garment donning station for cleanliness control. Special test equipment discussed include: an access tunnel for crew ingress/egress; a support device for the docking module (DM) and simulators; a command module thermal simulator; a DM infrared (IR) simulator; a docking system IR simulator; a metabolic heat load simulator; and a television camera simulator. Author

N76-11154* Martin Marietta Corp., Denver, Colo.
PREPARATION, CONTROL, AND USE OF STANDARD OPERATING PROCEDURES IN A SPACE SIMULATION LABORATORY
R. P. Parish, Jr. *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 533-536 (For availability see N76-11113 02-09)
(Paper-42) CSCL 14B

The degree of success in the operation of a space simulation laboratory is a direct function of the role of its standard operating procedures. Their proper use in a thermal vacuum test effects a wellrun test program. Preparation and procedure control are discussed. Author

N76-11155* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESIGN AND APPLICATION OF A GONIOPHOTOMETER
M. W. Finkel, J. B. Heaney, and R. K. Brookshier *In its* 8th Conf. on Space Simulation 1975 p 537-547 refs (For availability see N76-11113 02-09)
(Paper-43) CSCL 14B

The optical design of a goniophotometer is discussed. Several features such as polarization, signal-aperture interaction, and backscattering about the normal are also treated. A simplified method of integrating the total reflectance is illustrated. Author

N76-11156* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SCATTERING FROM SPECULAR SURFACES
M. W. Finkel *In its* 8th Conf. on Space Simulation 1975 p 549-561 refs (For availability see N76-11113 02-09)
(Paper-44) CSCL 14B

Diffraction by nearly specular Guassian surfaces is discussed according to the Beckmann Treatment and Fourier optics. It is shown that the fundamental parameters beta, the RMS roughness and correlation T, the correlation distance can be determined by scattering measurements. Author

N76-11157* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SKYLAB FLUID MECHANICS SIMULATIONS: OSCILLATION, ROTATION, COLLISION AND COALESCENCE OF WATER DROPLETS UNDER LOW-GRAVITY ENVIRONMENT
Otha H. Vaughan, Jr. and R. J. Hung (Alabama Univ., Huntsville) *In its* 8th Conf. on Space Simulation 1975 p 563-574 refs (For availability see N76-11113 02-09)
(Paper-45) CSCL 14B

Skylab 4 crew members performed a series of demonstrations showing the oscillations, rotations, as well as collision coalescence of water droplets which simulate various physical models of fluids under low gravity environment. The results from Skylab demonstrations provide information and illustrate the potential of an orbiting space-oriented research laboratory for the study of more sophisticated fluid mechanic experiments. Experiments and results are discussed. Author

N76-11158* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIZE DISTRIBUTION OF FRAGMENT DEBRIS PRODUCED BY SIMULATED METEOROID IMPACT OF SPACECRAFT WALL
T. Dale Bess *In its* 8th Conf. on Space Simulation 1975 p 575-590 refs (For availability see N76-11113 02-09)
(Paper-46) CSCL 14B

A laboratory experimental program was conducted to determine the amount of fragment debris produced and its size distribution when simulated spacecraft walls are penetrated by hypervelocity projectiles. Two tests were made in which a spacecraft wall was struck with a small steel and an aluminum projectile, respectively. Results show that most of the fragment debris were irregularly shaped flat plates. The fragment data follow a cumulative number distribution law of the form $N = am'b'$ where 'm' is fragment mass and 'a' and 'b' are constants. Orbital lifetimes of most of the fragments were very short, being on the order of a few days. Author

N76-11159* General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
APPLICATION AND UTILIZATION OF A SPACE CHAMBER FOR THE DRYING AND DECONTAMINATION OF BOOKS, DOCUMENTS AND OTHER MATERIALS
Martin G. Koesterer and John A. Geating *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 589-590 (For availability see N76-11113 02-09)
(Paper-47) CSCL 14B

Truckloads of materials such as rare books, papers, engineering drawings, blue prints, art work, leather objects such as shoes, and clothing were successfully dried, decontaminated and impregnated against future infestation by microorganisms in a large 12 x 24 foot vacuum chamber designed originally for testing unmanned spacecraft. The process is unique in that it allows either frozen or wet material, soaked by some castastrophic event to be dried and sterilized in the same chamber with a minimum of handling and transportation. Author

N76-11160* McDonnell Aircraft Co., St. Louis, Mo.
THE HIGH CURRENT TRANSIENT GENERATOR, THEORY AND OPERATION FOR SIMULATING LIGHTNING INDUCED VOLTAGES INTO AEROSPACE ELECTRICAL CIRCUITS
E. H. Schulte *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 591-608 refs (For availability see N76-11113 02-09)
(Contract F33657-70-C-0300)
(Paper-48) CSCL 14B

Because of the difficulty, hazard, and cost of simulating full-scale lightning currents on flight vehicles, a nondestructive test technique using reduced-scale lightning currents was used to determine if threat level voltages will be induced into aircraft electrical circuits in the event the aircraft is actually struck by lightning. The reasoning and theory of selecting a particular simulated lightning waveshape and magnitude is given, showing that extrapolation of induced waveforms over several orders of magnitude should be avoided. The operation of high-current transient generators and hardware are described along with typical applications. The means by which voltages were generated, induced, and measured, as well as possible sources of error, are discussed. Author

N76-11161* McDonnell-Douglas Corp., St. Louis, Mo.
A STUDY OF MOLECULAR CONTAMINATION
T. H. Allen, T. A. Hughes, and B. C. Price (AFML) *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 609-622 refs (For availability see N76-11113 02-09)
(Contract F33615-73-C-5091)
(Paper-49) CSCL 14B

Contamination kinetics of typical space materials were studied using several techniques, including ellipsometry. Data were obtained on contaminant deposition rates, sticking coefficients, and reevaporation of the contamination. Materials studied included silicone sealants, a thermal control paint, and a graphite laminate as contaminant sources, and gold coated surfaces, a thermal control paint and a second surface mirror material as the contaminees. Both deposition and reevaporation rates were found to be nonlinear with time, and followed an exponential decay. A hypothesis is presented that the nonlinear behavior was a result of disproportionation of the molecular weight fractions of the polymers. The measured sticking coefficients were found to vary substantially with temperature over narrow ranges. Simulated space radiation was found to reduce the evaporation rates of contaminants by several orders of magnitude. Author

N76-11162* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A SYSTEM FOR THE STUDY OF MOLECULAR CONTAMINATION
C. F. Dillow (McDonnell Douglas Corp., St. Louis, Mo.), T. H. Allen, R. M. F. Linford (McDonnell Douglas Corp., St. Louis, Mo.), and R. G. Richmond *In its* 8th Conf. on Space Simulation 1975 p 623-633 ref (For availability see N76-11113 02-09)
(Contract NAS9-13606)
(Paper-50) CSCL 14B

An experimental vacuum chambers was designed and fabricated to provide a wide range of experimental capability. This work chamber assembly (WCA) was conceived to establish the proof-of-principle of various techniques for studying the kinetics of contaminants and their effects. It incorporates the capability for depositing both optical and contaminant films on temperature-controlled samples, and for in-situ measurements of the vacuum ultraviolet reflectance. Ellipsometer optics are mounted on the chamber for film thickness determinations, and other features include access ports for radiation sources and instrumentation. Author

N76-11163* McDonnell-Douglas Corp., St. Louis, Mo.
OPTICAL MEASUREMENTS ON CONTAMINATED SURFACES
T. E. Bonham, R. J. Schmitt, and R. M. F. Linford *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 635-644 refs (For availability see N76-11113 02-09)
(Contract F33615-73-C-0591)
(Paper-51) CSCL 14B

A bidirectional reflectometer system was developed for in situ measurements of the changes in spectral reflectance of surfaces contaminated with films of organic materials. The system permits experiments with films of controlled thickness in an environment that simulates the thermal, radiation, and vacuum conditions of space. The mechanical and optical construction of the reflectometer are discussed in detail, and actual data curves are used to illustrate its operation and performance. Author

N76-11164* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A LASER PARTICULATE SPECTROMETER FOR A SPACE SIMULATION FACILITY
R. J. Schmitt (McDonnell Douglas Corp., St. Louis, Mo.), B. A. Boyd (McDonnell Douglas Corp., St. Louis, Mo.), R. M. F. Linford (McDonnell Douglas Corp., St. Louis, Mo.), and R. G. Richmond

In its 8th Conf. on Space Simulation 1975 p 647-661 refs (For availability see N76-11113 02-09)
(Contract NAS9-14171)
(Paper-53) CSCL 14B

A laser particulate spectrometer (LPS) system was developed to measure the size and speed distributions of particulate contaminants. Detection of the particulates is achieved by means of light scattering and extinction effects using a single laser beam to cover a size range of 0.8 to 275 microns diameter and a speed range of 0.2 to 20 meters/second. The LPS system was designed to operate in the high-vacuum environment of a space simulation chamber with cold shroud temperatures ranging from 77 to 300 K. Author

N76-11165* International BioPhysics Corp., Costa Mesa, Calif.
PARTICULATE SIZE DISTRIBUTION CASCADE ANALYZER FOR SPACECRAFT CONTAMINATION MONITORING
Donald A. Wallace and Raymond L. Chuan *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 663-664 (For availability see N76-11113 02-09)
(Paper-54) CSCL 14B

A cascade particulate analyzer was developed for nearly real time measurement of the contaminating particulate size distribution in the spacecraft interior ambient environment and as a real time total impacting particulate mass monitor under vacuum conditions. The analyzer has four stages, the first stage is a basic 10 MHz quartz crystal microbalance used widely on spacecraft (such as Skylab) for contamination monitoring purposes. In this application the front sensing crystal is coated with a low vapor pressure adhesive grease which captures impacting particles. This first stage has a wide viewing angle and measures total particulate mass impacting the crystal while the unit is exposed to the vacuum environment. The remaining three states form an aerodynamic impaction cascade with individual quartz crystal microbalances at each stage acting as accumulated mass sensing elements. These three stages thus give relative mass distribution of particulates in three ranges, particles having effective diameter greater than 5 micron, particles between 1 and 5 micron diameter and particles 0.3 to 1 micron diameter. Author

N76-11166* Boeing Co., Seattle, Wash.
DEVELOPMENT OF A LABORATORY DEMONSTRATION MODEL ACTIVE CLEANING DEVICE
R. L. Shannon and R. B. Gillette *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 665-687 refs (For availability see N76-11113 02-09)
(Paper-55) CSCL 14B

A laboratory demonstration model of a device for removing contaminant films from optical surfaces in space was developed. The development of a plasma tube, which would produce the desired cleaning effects under high vacuum conditions, represented the major problem in the program. This plasma tube development is discussed, and the resulting laboratory demonstration-model device is described. Author

N76-11167* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WALKING IN A ROTATING SPACE STATION, AN ELECTROMYOGRAPHIC AND KINEMATIC STUDY
Randall L. Harris *In its* 8th Conf. on Space Simulation 1975 p 689-704 refs (For availability see N76-11113 02-09)
(Paper-56) CSCL 14B

Biomechanics were studied of locomotion in a rotating environment like that of a space station at various gravity levels. Comparisons were made of the walking gait patterns and the amplitudes of various leg muscle electrical outputs at different gravity levels. The results of these tests are applicable to planning future space missions by providing a part of the information that will be needed to determine the type of vehicle and the gravity level to be provided for the astronauts if it is decided that artificial gravity is to be utilized. Author

N76-11168* Pennsylvania Univ., Philadelphia. Plant Centrifuge Lab.
COMPARISON OF TWO METHODS OF PREDICTING CHARACTERISTICS OF AN ORGANISM WHICH DEVELOPS UNDER THE CONDITION OF FREE FALL
A. H. Brown, A. O. Dahl, D. K. Chapman, and L. Loercher *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 705-710 refs (For availability see N76-11113 02-09)
(Paper-57) CSCL 14B

Five morphological characteristics of Arabidopsis thaliana were measured on plant populations grown under continuous centrifugation. In separate tests different g-levels were used. For each character studied a linear g-function was calculated and extrapolated to zero-g. In other tests Arabidopsis plants were grown on horizontal clinostats after which the same set of characters was measured. Growth on a clinostat might simulate growth at zero-g; but the zero-g predictions by the two methods did not agree consistently. The results were significantly different for three of the five characters for which comparisons were made. Either the extrapolation method or the clinostat method are considered unreliable as a means of predicting plant growth characteristics in the weightless environment of an earth satellite laboratory. Author

N76-11169* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A THERMAL VACUUM-UV SOLAR SIMULATOR TEST SYSTEM FOR ASSESSING MICROBIOLOGICAL VIABILITY
Dennis S. Ross, Michael D. Wardle, and Daniel M. Taylor *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 711-721 refs (For availability see N76-11113 02-09)
(Paper-58)

Microorganisms were exposed to a simulated space environment in order to assess the photobiological effect of broad spectrum, nonionizing solar electromagnetic radiation in terms of viability. A thermal vacuum chamber capable of maintaining a vacuum of 0.000133n/sq m and an ultraviolet rich solar simulator were the main ingredients of the test system. Results to date indicate the system to be capable of providing reliable microbiological data. Author

N76-11170* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIFE SCIENCES LABORATORY BREADBOARD SIMULATIONS FOR SHUTTLE
S. T. Taketa, R. C. Simmonds, and P. X. Callahan *In its* 8th Conf. on Space Simulation 1975 p 723-739 refs (For availability see N76-11113 02-09)
(Paper-59)

Breadboard simulations of life sciences laboratory concepts for conducting bioresearch in space were undertaken as part of the concept verification testing program. Breadboard simulations were conducted to test concepts of and scope problems associated with bioresearch support equipment and facility requirements and their operational integration for conducting manned research in earth orbital missions. It emphasized requirements, functions, and procedures for candidate research on crew members (simulated) and subhuman primates and on typical radioisotope studies in rats, a rooster, and plants. Author

N76-11171* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METABOLIC RATE CONTROL DURING EXTRAVEHICULAR ACTIVITY SIMULATIONS AND MEASUREMENT TECHNIQUES DURING ACTUAL EVAS
David J. Horrigan *In its* 8th Conf. on Space Simulation 1975 p 741-748 refs (For availability see N76-11113 02-09)
(Paper-60) CSCL 14B

A description of the methods used to control and measure metabolic rate during ground simulations is given. Work levels attained at the Space Environment Simulation Laboratory are presented. The techniques and data acquired during ground simulations are described and compared with inflight procedures. Data from both the Skylab and Apollo Program were utilized and emphasis is given to the methodology, both in simulation and during flight. The basic techniques of work rate assessment are described. They include oxygen consumption, which was useful for averages over long time periods, heart rate correlations based on laboratory calibrations, and liquid cooling garment temperature changes. The relative accuracy of these methods as well as the methods of real-time monitoring at the Mission Control Center are discussed. The advantages and disadvantages of each of the metabolic measurement techniques

are discussed. Particular emphasis is given to the problem of utilizing oxygen decrement for short time periods and heart rate at low work levels. A summary is given of the effectiveness of work rate control and measurements; and current plans for future EVA monitoring are discussed. Author

N76-11172* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE USE OF A MODEL OF HUMAN THERMOREGULATION DURING THE APOLLO AND SKYLAB PROGRAMS
James M. Waligora *In its* 8th Conf. on Space Simulation 1975 p 749-757 refs (For availability see N76-11113 02-09)
(Paper-61) CSCL 14B

A model of thermoregulation in man was used operationally during the Apollo and Skylab programs. The evolution of this description of thermoregulation is discussed as well as the supporting research programs that led to its growth in representational detail and operational accuracy. A discussion of the operational use of the model is presented as well as future applications of the model. Author

N76-11173* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EVALUATION OF THE GRAVITY INDEPENDENT MINIATURE ANALYTICAL SYSTEM
Larry D. Wallace (Northrop Services, Inc., Houston, Tex.), Carolyn S. Leach, and C. B. Lassiter (Northrop Services, Inc., Houston, Tex.) *In its* 8th Conf. on Space Simulation 1975 p 759-768 ref (For availability see N76-11113 02-09)
(Paper-62) CSCL 14B

The miniature fast analyzer is an automated, analytical instrument developed for potential use for biochemical analyses conducted in space flight. The gravity independent fast analyzer system is described which consists of a 17 place rotor type spectrophotometer and computerized data acquisition system weighing only 30 pounds and occupying a volume of 1 cubic foot. Author

N76-11174* Stanford Univ., Calif. School of Medicine.
PROPOSED APPLICATION OF LOWER BODY NEGATIVE PRESSURE TO CARDIOLOGY
E. V. Schmidt, R. F. DeBusk, and R. L. Popp *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 769-782 refs (For availability see N76-11113 02-09)
(Paper-63) CSCL 14B

Potential medical applications are presented of lower body negative pressure to the evaluation and treatment of cardiac patients. The essential features of an LBNP unit and the basic cardiovascular physiology of lower body negative pressure (LBNP) testing are described. Some of the results of previous spaceflight experiences and bedrest studies are summarized. The deconditioning effects of weightlessness experienced by orbiting astronauts are compared with the effects of bedrest restrictions prescribed for convalescing cardiac patients. The potential of LBNP for evaluating both pharmacological and physical activity regimens was examined, particularly in relation to post-myocardial infarction and coronary artery bypass patients. Applications of LBNP to the cardiac catheterization laboratory and the out-patient follow-up of cardiac patients are proposed. Author

N76-11175* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CALIBRATION SOURCE FOR REMOTE SENSORS
J. T. McLean, A. McCulloch, and E. I. Mohr (Columbia Union Coll.) *In its* 8th Conf. on Space Simulation 1975 p 783-796 refs (For availability see N76-11113 02-09)
(Paper-64) CSCL 14B

The source described was developed as a calibration target for the multispectral scanner (MSS) which was flown on the Earth Resources Technology Satellite A (LANDSAT 1). The wavelength region of interest covered the four (4) MSS bands extending from 0.5 to 1.1 micrometers, although the target was calibrated from 0.32 to 2.5 micrometers. The following characteristics for the target were required: (1) large aperture, sufficient to accommodate an instrument with a 9 inch (23 centimeters(cm)) aperture and 2 1/2 deg field of view (fov), (2) highly diffuse energy from target, (3) high spatial uniformity across aperture area of source, (4) spectrally calibrated in absolute units, (5) stable output over long periods of time (1-2 yrs), and (6) rugged, yet portable enough to be easily transported long distances without detrimental effects on the operational capabilities of the target. Two approaches were considered: a thirty (30) inch (76 cm) diameter integrating sphere with a twelve inch (30.5 cm) exit port, or the use of one hemisphere of a 76 cm sphere in conjunction with a Kodak ektolite screen. The screen has the property of reflecting back uniformly into a well defined area the majority of the light received. After some preliminary trials it seemed that the 76 cm sphere would give the most satisfactory results. Author

N76-11176* National Bureau of Standards, Boulder, Colo.
CURRENT STATUS AND FUTURE PLANS FOR NBS RADIOMETRIC SOURCE STANDARDS
Henry J. Kostkowski *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 799-805 refs (For availability see N76-11113 02-09)
(Paper-66) CSCL 14B

The accuracy and long-term stability of currently available NBS radiometric source standards are described. Current research efforts and expected results in this area are outlined. There are over ten NBS radiometric source standards currently available or under development that are of interest for solar measurements or for remote sensing of the earth. The standards and sources are classified and described in terms of the radiometric quantities they represent -- spectral radiance, spectral irradiance and irradiance. Author

N76-11177* Eppley Lab., Inc., Newport, R.I.
INITIAL SOLAR RADIATION MEASUREMENTS FROM ERB
J. R. Hickey, F. J. Griffin, and D. T. Hilleary (NOAA) *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 809-814 refs (For availability see N76-11113 02-09)
(Paper-68) CSCL 14B

Some preliminary comments on the results of the solar radiation measurements from the earth radiation budget experiment of the NIMBUS 6 satellite are discussed. Author

N76-11178* American Instrument Co., Silver Spring, Md.
QUANTITATIVE DETERMINATION OF SMOKE AND TOXIC PRODUCT POTENTIAL OF MATERIALS WITH THE AMINCO (REGISTERED) NBS SMOKE DENSITY CHAMBER
Samuel Greenberg *In* NASA. Goddard Space Flight Center 8th Conf. on Space Simulation 1975 p 815-832 refs (For availability see N76-11113 02-09)
(Paper-69) CSCL 14B

Quantitative measurements of smoke obscuration produced by standard area samples under high energy pyrolysis both with and without an ignition source, using a collimated vertical light beam in conjunction with an ultra-linear photomultiplier microphotometer are obtainable with the smoke density chamber. Results are expressed in dimensionless specific optical density permitting usage calculations in accordance with a geometric relationship. Author

N76-11179* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FIRE-RESISTANT AIRCRAFT MATERIALS DEVELOPMENT AND EVALUATION PROGRAM
Richard W. Bricker and Robert N. Stuckey *In its* 8th Conf. on Space Simulation 1975 p 833-854 refs (For availability see N76-11113 02-09)
(Paper-70) CSCL 14B

An aircraft flammability program was undertaken to utilize spacecraft developed fire-resistant materials to improve passenger safety and decrease losses from unattended fires in commercial aircraft. Five full-scale aircraft flammability tests were performed to evaluate the effectiveness of improved fire-resistant materials by comparing their burning characteristics with those of pre-1968 aircraft materials. Author

N76-11180* Martin Marietta Aerospace, Denver, Colo.
DEVELOPMENT OF FIRE RESISTANT ELECTRONIC CONFIGURATIONS FOR USE IN OXYGEN ENRICHED ENVIRONMENTS
F. J. Smith *In* NASA. Goddard Space Flight Center 8th Conf.

on Space Simulation 1975 p 855-858 refs (For availability see N76-11113 02-09)
(Paper-71) CSCL 14B

Design concepts for electronic black boxes and modules were tested in oxygen enriched atmospheres, and it was found that various types of sealed configurations would generally eliminate any flammability hazard. The type of configuration and its construction was found to be of more importance in the elimination of flammability hazards in electronic configurations than the types of materials utilized in them. The design concepts developed for fire hazard free electronic configurations for use in manned space programs are applicable for the design of electronic hardware for any use or environment. Author

N76-11181# Arbeitsgemeinschaft Deutscher Verkehrsflughaefen, Stuttgart (West Germany).
INFRASTRUCTURE REQUIREMENTS FOR STOL AIR TRAFFIC IN FEDERAL REPUBLIC OF GERMANY [INFRASTRUKTURERFORDERNISSE FUER EINEN STOL-LUFTVERKEHR IN DER BUNDESREPUBLIK DEUTSCHLAND]
Volkmar Stein and Udo Wolffram Dec. 1974 151 p refs In GERMAN Sponsored by Bundesmin. fuer Verkehr
Avail: NTIS HC $6.75

A definition and delimitation of the STOL concept is given with reference to future requirements of STOL traffic. Two characteristic reference aircraft are selected and described based on this definition. The reference parameters for related operational and check-in areas, as well as obstacle clearance surfaces and building restrictions zones, are derived. Airport models comparable to conventional airports are the result. Taking into account the possible STOL traffic tasks and expected noise performance, a conclusion is drawn as to the most effective arrangement of STOL airport installation in populated regions. ESA

N76-11182# European Space Agency, Paris (France).
THE M4 SUPERSONIC WIND TUNNEL
Wolfgang Langefeld et al Jul. 1975 59 p refs Transl. into ENGLISH of "Ueberschall-Windkanal M4', Rheinisch-Westfael. Tech. Hochschule, Aachen Report DLR-Mitt-74-14, 13 Feb. 1974 Original German report available from DFVLR, Porz, West Ger. 24.30 DM
(ESA-TT-177; DLR-Mitt-74-14) Avail: NTIS HC $4.50

The M4 (20 x 20 cm) supersonic wind tunnel, including the instrumentation and control rooms, at the Institut fuer Luft-und Raumfahrt of the Technical University of Aachen is described. The wind tunnel is of an intermittent blow-down-type with the laval nozzle and diffusor adjustable, while in operation over the range form M = 1 to M = 4. Author (ESA)

N76-11183# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
ENGINEER DESIGN TESTS OF DOW TRUSS WEB LANDING MATS WITH WATERPROOFABLE CONNECTORS AND SEALS Final Report
Gordon L. Carr May 1975 84 p refs
(DA Proj. 1T1-62112-A-528)
(AD-A012068; AEWES-Misc-Paper-s-75-13) Avail: NTIS CSCL 01/5

Dow truss web waterproofable landing mat was tested without seals under a 50,000-lb single-wheel load (SWL) with 250-psi tire inflation pressure on a four-CBR subgrade to determine its life in coverages. The panels were placed at a rate of 822 sq ft per man-hour. The full and half panels sustained 1440 coverages of the above loading on a four-CBR subgrade. A limited number of mats with seals were tested to evaluate the effectiveness of the seal using a C-5A loading (26,600-lb SWL with 100-psi tire inflation pressure) on a 12-CBR subgrade during a two-month period while natural and simulated rainfall of over 10 in. was recorded. GRA

N76-11184# Illinois Univ., Urbana. Aviation Research Lab.
EFFECTIVE AND ECONOMICAL SIMULATION IN THE DESIGN AND USE OF AEROSYSTEMS Interim Report
Stanley N. Roscoe Apr. 1975 31 p
(Contract F44620-70-C-0105)
(AD-A012012; ARL-75-8/AFOSR-75-3; AFOSR-75-0869TR) Avail: NTIS CSCL 14/2

This paper is a lightly edited transcript of a 1975 talk presented at a conference on simulation of aero systems cosponsored by the Air Force Office of Scientific Research and the Air Force Flight Dynamics Laboratory. The characteristics of aircraft simulators leading to their effective and economical use are shown experimentally to differ as a function of their application, whether in engineering research, pilot performance assessment and prediction or training. Issues in the design and use of flight training simulators involve the effectiveness and economics of motion systems, visual systems, and performance measurement systems. GRA

N76-11185# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
FOAMED-IN-PLACE POLYURETHANE INSULATED TRAFFIC TEST SECTIONS FOR EXPEDIENT ROADS
N. Smith, R. L. Berg, and L. Muller Jun. 1975 24 p refs
(DA Proj. 4A0-62103-A-894)
(AD-A012115; CRREL-TR-262) Avail: NTIS CSCL 01/5

Foamed-in-place polyurethane was tested as an expedient road surface insulation and load distributing structural layer with T15 aluminum airfield landing mat as a trafficking surface. The insulation was sprayed on leveling courses of either woodchips or gravel with thicknesses of about 15 cm. Various thicknesses of insulation were used singly and in combination. Total insulation thicknesses ranged from 2.5 to 28 cm. The test sections were trafficked during the thaw seasons with a dump truck loaded with gravel. The total test vehicle weight was 12,270 kg with a maximum single wheel load of 2,415 kg. The test sections withstood over 1,000 passes of the test vehicle without suffering complete failure. Observations showed settlements of 0.0 to 14.0 cm and thaw depths in the subgrade from 24.0 to 99 cm. This method of expedient road construction would provide satisfactory service throughout two thaw seasons or longer without deleterious effects to the subgrade and adjacent environment. GRA

N76-11186# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
LANDING MAT OVER MEMBRANE-ENVELOPED SOIL Final Report
Cecil D. Burns and George L. Regan Jun. 1975 87 p refs
(DA Proj. 4A0-62103-A-859)
(AD-A012142; AEWES-Misc-Paper-S-75-14) Avail: NTIS CSCL 01/5

The study was conducted to evaluate the effectiveness of a membrane-encased soil layer (MESL) base course under medium-duty landing mat when subjected to C-141 aircraft loading. A special test section consisting of five test items was constructed and trafficked. Test item 1 was considered a control item and was designed to support about 1000 coverages of the C-141 aircraft loading. The design was based on current criteria for airfields surfaced with medium-duty mats. Items 2-5 were designed for MESL base courses of reduced thicknesses. The test included both XM18 and XM19 mats. The test section was subjected to traffic with one main gear of a C-141 aircraft assembly (twin-tandem assembly) loaded to 146,000 lb. GRA

N76-11060 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
THE TRANSONIC TEST-SECTION FOR AIRFOIL MEASUREMENTS IN THE INSTITUTE FOR AERODYNAMICS, BRAUNSCHWEIG
G. Kausche *In* ESA Aerodynamics of Airfoils in Transonic Flow (ESA-TT-175) Jul. 1975 p 272-287 refs Transl. into ENGLISH from "Tragfluegel-Aerodynamik bei schallnahen Stroemungen", DGLR, Cologne Report DLR-Mitt-73-04, 1973 p 329-346 (For availability see N76-11048 02-02)
(DGLR-Paper-72-133)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N76-11187*# Kanner (Leo) Associates, Redwood City, Calif.
SOYUZ-APOLLO
M. F. Rebrov and L. A. Gilberg Washington NASA Oct. 1975 107 p Transl. into ENGLISH of the book "Soyuz-Apollon" Moscow, Mashinostroyeniye Press, 1975 p 1-96
(Contract NASw-2790)
(NASA-TT-F-16580) Avail: NTIS HC $5.50 CSCL 22C

The history of U.S. and U.S.S.R. manned space flight was discussed, with particular reference to space rendezvous and docking. Modifications of Apollo and Soyuz and development of the androgynous peripheral docking unit and transfer module were presented. Control of the joint flight, the scientific and technical experimental program and the Baykinur and Canaveral space ports were discussed. Biographical information on the primary and backup crews of Apollo and Soyuz was given. Preparations and rehearsals in the U.S.A and U.S.S.R. and in orbit (Soyuz-16) for the joint flight were commented on. Author

N76-11188*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LESSONS LEARNED ON THE SKYLAB PROGRAM
18 Jul. 1974 151 p
(NASA-TM-X-72920; JSC-09096) Avail: NTIS HC $6.75 CSCL 22C

Lessons learned in the Skylab program and their application and adaptation to other space programs are summarized. Recommendations and action taken on particular problems are described. The use of Skylab recommendations to identify potential problems of future space programs is discussed. Author

N76-11189*# Techtran Corp., Glen Burnie, Md.
MY BLUE PLANET
G. S. Titov Washington NASA Oct. 1975 229 p Transl. into ENGLISH of the book "Golubaya Moya Planeta" Moscow, Mil. Press, 1973 p 1-239
(Contract NASw-2485)
(NASA-TT-F-811) Avail: NTIS HC $8.00 CSCL 22B

A biographical sketch of cosmonaut German Titov is given. The training in flying school and the experience of flight in space is emphasized. The future of the conquest of space is considered. Author

N76-11190*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
SPACE PROCESSING OF CRYSTALS FOR OPTO-ELECTRONIC DEVICES: THE CASE FOR SOLUTION GROWTH Final Report
S. C. Hayden and L. E. Cross 10 Sep. 1975 85 p refs
(Contract NAS8-31152)
(NASA-CR-144028) Avail: NTIS HC $5.00 CSCL 20B

The results obtained during a six month program aimed at determining the viability of space processing in the 1980's of dielectric-elastic-magnetic single crystals were described. The results of this program included: identification of some important emerging technologies dependent on dielectric-elastic-magnetic crystals, identification of the impact of intrinsic properties and defects in the single crystals on system performance, determination of a sensible common basis for the many crystals of this class, and identification of the benefits of micro-gravity and some initial experimental evidence that these benefits can be realized in space. It is concluded that advanced computers and optical communications are at a development stage for high demand of dielectric-elastic-magnetic single crystals in the mid-1980's. Their high unit cost and promise for significantly increased perfection by growth in space justified pursuit of space processing. Author

N76-11191*# Westinghouse Research Labs., Pittsburgh, Pa.
FURNACE AND SUPPORT EQUIPMENT FOR SPACE PROCESSING Final Report
R. Mazelsky, C. S. Duncan, R. G. Seidensticker, R. A. Johnson, R. H. Hopkins, and G. W. Roland Feb. 1975 66 p
(Contract NAS8-30289)
(NASA-CR-144027) Avail: NTIS HC $4.50 CSCL 13H

A core facility capable of performing a majority of materials processing experiments is discussed. Experiment classes are described, the needs peculiar to each experiment type are outlined, and projected facility requirements to perform the experiments are treated. Control equipment (automatic control) and variations of the Czochralski method for use in space are discussed. Author

N76-11192*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: GUIDANCE AND CONTROL SYSTEMS. LUNAR MODULE STABILIZATION AND CONTROL SYSTEM
D. Harold Shelton Washington Nov. 1975 21 p ref
(NASA-TN-D-8086; JSC-S-419) Avail: NTIS HC $3.50 CSCL 22B

A brief functional description of the Apollo lunar module stabilization and control subsystem is presented. Subsystem requirements definition, design, development, test results, and flight experiences are discussed. Detailed discussions are presented of problems encountered and the resulting corrective actions taken during the course of assembly-level testing, integrated vehicle checkout and test, and mission operations. Although the main experiences described are problem oriented, the subsystem has performed satisfactorily in flight. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-11193*# Chrysler Corp., Detroit, Mich. Flight Technology Branch.
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY. PART 3: FINAL DOCUMENTATION
A. B. Carter, G. W. Klug, and N. W. Williams 21 Jan. 1975 302 p refs
(Contract NAS8-4016)
(NASA-CR-144043; TN-FT-74-35-Pt-3) Avail: NTIS HC $9.75 CSCL 22C

Trajectory data are presented for a nominal and two launch window trajectory simulations. These trajectories are designed to insert a manned Apollo spacecraft into a 150/167 km. (81/90 n. mi.) earth orbit inclined at 51.78 degrees for rendezvous with a Soyuz spacecraft, which will be orbiting at approximately 225 km. (121.5 n. mi.). The launch window allocation defined for this launch is 500 pounds of S-IVB stage propellant. The launch window opening trajectory simulation depicts the earliest launch time deviation from a planar flight launch which conforms to this constraint. The launch window closing trajectory simulation was developed for the more stringent Air Force Eastern Test Range (AFETR) flight azimuth restriction of 37.4 degrees east-of-north. These trajectories enclose a 12.09 minute launch window, pertinent features of which are provided in a tabulation. Planar flight data are included for mid-window reference. Author

N76-11194*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A TETHER TENSION CONTROL LAW FOR TETHERED SUBSATELLITES DEPLOYED ALONG LOCAL VERTICAL
Charles C. Rupp 1 Sep. 1975 31 p refs
(NASA-TM-X-64963) Avail: NTIS HC $4.00 CSCL 22A

A tethered subsatellite deployed along the local vertical is in stable equilibrium. This applies equally to subsatellites deployed in the direction towards the earth from the main spacecraft or away from the earth. Momentary perturbations from this stable equilibrium will result in a swinging motion, which decays very slowly if passive means are relied upon to provide damping. A control law is described which actively damps the swinging motion by employing a reel, or other mechanism, to apply appropriate tension as a function of tetherline length, rate of change of length, and desired length. The same control law is shown to be useful for deployment and retrieval of tethered subsatellites in addition to damping to steady state. Author

N76-11195*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
MANNED ORBITAL SYSTEMS CONCEPTS STUDY. BOOK 1: EXECUTIVE SUMMARY
30 Sep. 1975 41 p

(Contract NAS8-31014)
(NASA-CR-144062; MDC-G5919-Bk-1) Avail: NTIS HC $4.00 CSCL 22A

Requirements for and definitions of a cost effective orbital facility concept, capable of supporting extended manned operations in earth orbit beyond those visualized for the 7 to 30 day shuttle/spacelab system, were studied. Data are given on requirements derivation, concepts identification, systems analysis and definition, and programmatics. Author

N76-11196*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
MANNED ORBITAL SYSTEMS CONCEPTS STUDY. BOOK 2: REQUIREMENTS FOR EXTENDED-DURATION MISSIONS
30 Sep. 1975 168 p refs
(Contract NAS8-31014)
(NASA-CR-144063; MDC-G5919-Bk-2) Avail: NTIS HC $6.75 CSCL 22A

In order to provide essential data needed in long-range program planning, the Manned Orbital Systems Concepts (MOSC) study attempted to define, evaluate, and compare concepts for manned orbital systems that provide extended experiment mission capabilities in space, flexibility of operation, and growth potential. Specific areas discussed include roles and requirements for man in future space missions, requirements for extended capability, mission/payload concepts, and preliminary design and operational requirements. Author

N76-11197*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
MANNED ORBITAL SYSTEMS CONCEPT STUDY. BOOK 4: PROGRAMMATICS FOR EXTENDED-DURATION MISSIONS
30 Sep. 1975 147 p ref
(Contract NAS8-31014)
(NASA-CR-144064; MDC-G5919-Bk-4) Avail: NTIS HC $6.00 CSCL 22A

The cost estimates, schedule data, and funding distributions generated in the Manned Orbital Systems Concepts (MOSC) study are presented. The overall objectives were to examine the requirements for, and to describe, a cost-effective concept for an orbital facility capable of supporting manned operations in earth orbit beyond the 7-to-30-day mission duration provided by the Shuttle/Spacelab system. The cost, schedule, and other programmatic data were developed to provide information useful for their long-range planning activities. The major portion of the data documented and discussed consists of project- and system-level schedule and funding information and also project-, system-, and subsystem-level cost summaries. Author

N76-11198*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
MANNED ORBITAL FACILITY: A USER'S GUIDE
Jul. 1975 44 p
(Contract NAS8-31014)
(NASA-CR-144065; MDC-G5957) Avail: NTIS HC $4.00 CSCL 22A

The salient conceptual features and expected evolution of the facility are discussed; the baseline design is offered as a model against which the reader can compare his needs. The overall program is discussed, supporting services and resources are described, and examples of typical payload applications are given. The general design features and configurations representing the baseline MOF developed and derived with due consideration given to applicable designs and subsystems such as those available in the Skylab, orbiter, and space lab vehicles. Author

N76-11199*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EXTERIOR TIDAL POTENTIAL ACTING ON A SATELLITE
Peter Musen Sep. 1975 31 p refs Submitted for publication
(NASA-TM-X-70998; X-920-75-220) Avail: NTIS HC $4.00 CSCL 22C

A theory is presented that points out the existence of several long period and 'cross effects' in the coefficients in the expansion of the geopotential and in the motion of satellites. The tidal potential, defined as small periodic variations in the geopotential, was calculated. The influence of these geopotential variations on satellite perturbation is examined. Spherical harmonics were employed. J.R.T.

N76-11200*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PRIMER VECTOR THEORY AND APPLICATIONS
Donald J. Jezewski Washington Nov. 1975 48 p refs
(NASA-TR-R-454; JSC-S-439) Avail: NTIS HC $4.00 CSCL 22C

A method developed to compute two-body, optimal, N-impulse trajectories was presented. The necessary conditions established define the gradient structure of the primer vector and its derivative for any set of boundary conditions and any number of impulses. Inequality constraints, a conjugate gradient iterator technique, and the use of a penalty function were also discussed. Author

N76-11201*# Chrysler Corp., New Orleans, La. Flight Technology Branch.
ASTP (SA-210) LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY DISPERSION ANALYSIS, VOLUME 1
N. D. Williams, G. W. Klug, and F. A. Ransom 4 Apr. 1975 79 p refs
(Contract NAS8-4016)
(NASA-CR-144044; TN-FT-75-42-Vol-1) Avail: NTIS HC $5.00 CSCL 22C

In order to establish realistic deviation limits for the ASTP (SA-210) Launch Vehicle Operational Flight Trajectory, a dispersion analysis was conducted. The nominal trajectory prescribed for this analysis is the ASTP (SA-210) Launch Vehicle 500 Pound Launch Window Opening OT. The error sources considered are those associated with predictions of vehicle characteristics, vehicle systems performance, and flight environment. The nominal vehicle, the boost trajectory simulations, the error sources, the analytic procedures utilized, and the results are discussed. Launch vehicle guidance system inaccuracies were determined from the guidance error analysis. These data are composed of individual error source trajectory parameter dispersion envelopes. Author

N76-11202# Royal Aircraft Establishment, Farnborough (England).
GEOPOTENTIAL HARMONICS OF ORDER 15 AND ODD DEGREE FROM ANALYSIS OF RESONANT ORBITS
D. G. King-Hele, Doreen M. C. Walker, and R. H. Gooding Mar. 1975 44 p refs
(RAE-TR-75006; BR46825) Avail: NTIS HC $4.00

The variations of inclination were analyzed in 13 satellite orbits as they pass slowly, (under the action of air drag) through 15th-order resonance with the geopotential; successive equatorial crossings are 24 deg apart, and the ground track repeats after 15 revolutions. The size and form of the change in inclination were determined mainly by the values of the geopotential harmonics of 15th order and odd degree. Four of the orbits analyzed also yield good values for lumped harmonics of 30th order. Author (ESA)

N76-11923 Joint Publications Research Service, Arlington, Va.
MANNED SPACE FLIGHTS
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 74-80 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 7 p (For availability see N76-11919 02-88)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N76-11203*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MADRID SPACE STATION
R. J. Fahnestock and N. A. Renzetti [1975] 20 p In SPANISH and ENGLISH
(Contract NAS7-100)
(NASA-CR-145552; JPL-SP-43-26) Avail: NTIS HC $3.50 CSCL 20D

The Madrid space station, operated under bilateral agreements between the governments of the United States and Spain, is described in both Spanish and English. The space station utilizes two tracking and data acquisition networks: the Deep Space Network (DSN) of the National Aeronautics and Space Administration and the Spaceflight Tracking and Data Network (STDN) operated under the direction of the Goddard Space Flight Center. The station, which is staffed by Spanish employees, comprises four facilities: Robledo 1, Cebreros, and Fresnedillas-Navalagamella, all with 26-meter-diameter antennas, and Robledo 2, with a 64-meter antenna. Author

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-11204 AEG-Telefunken, Backnang (West Germany). Fachbereich Weitverkehr und Kabeltechnik.
CONSIDERATIONS ON THE FEASIBILITY AND TECHNOLOGY OF SOLAR ENERGY SATELLITES AND ENERGY TRANSFER SATELLITES [BETRACHTUNGEN ZUR DURCHFUEHRBARKEIT UND TECHNOLOGIE VON SONNENENERGIE-SATELLITEN UND ENERGIEUEBERTRAGUNGS-SATELLITEN]
May 1975 91 p refs In GERMAN; ENGLISH summary Prepared jointly with Dornier System and Tech. Univ. Berlin
(Contract GfW-RV-11-V-67/74-PZ-BB-74)
Copyright. Avail: Issuing Activity

An analysis of the technological development problems of using orbital systems (satellites) for the generation and transfer of energy from space was made. The possible role of solar energy and the use of satellites for the generation of energy in space or the transmission of energy through space were studied mainly in the U.S., with the conclusion that solar energy utilization could become attractive provided a number of technical and technological problems can be solved. Studies done so far are reviewed and problems concerning the realization of energy satellites are discussed. The main components of the systems studies are dealt with, transport problems and choice or orbits are indicated; and investment, operating, and energy costs are estimated. ESA

N76-11205*# Communications Satellite Corp., Clarksburg, Md.
INTEGRATED ORBITAL SERVICING AND PAYLOADS STUDY. VOLUME 1: EXECUTIVE SUMMARY
Sep. 1975 51 p refs
(Contract NAS8-30849)
(NASA-CR-144060) Avail: NTIS HC $4.50 CSCL 22A

A study is summarized in which a comparison was made of the following modes of maintaining a satellite system: (1) expendable mode in which failed satellites are replaced, (2) on-orbit servicing where a satellite can be fixed by unmanned module exchange in space, and (3) ground refurbishment in which the satellite is brought back to ground for repairs. It was concluded that on-orbit maintenance is the most cost-effective mode and that it is technically feasible. It can be used to repair failed satellites, to improve reliability of operating satellites, and to update equipment. On-orbit servicing can increase program flexibility and satellite reliability, lifetime, and availability. The significant conclusions and results of two studies are summarized. Author

N76-11206*# Communications Satellite Corp., Clarksburg, Md.
INTEGRATED ORBITAL SERVICING AND PAYLOADS STUDY. VOLUME 2: TECHNICAL AND COST ANALYSIS
Sep. 1975 93 p refs
(Contract NAS8-30849)
(NASA-CR-144061) Avail: NTIS HC $5.00 CSCL 22A

The details and background used in the investigation of orbital servicing and payloads are presented. Topics discussed include review of previous models, application of servicing to communications satellites, assessment of spacecraft servicing, cost of servicing, and launch vehicle effects on spacecraft. M.J.S.

N76-11207*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
EVALUATION OF A MICROWAVE HIGH-POWER RECEPTION-CONVERSION ARRAY FOR WIRELESS POWER TRANSMISSION
R. M. Dickinson 1 Sep. 1975 25 p refs
(Contract NAS7-100)
(NASA-CR-145625; JPL-TM-33-741) Avail: NTIS HC $3.50 CSCL 22B

Initial performance tests of a 24-sq m area array of rectenna elements are presented. The array is used as the receiving portion of a wireless microwave power transmission engineering verification test system. The transmitting antenna was located at a range of 1.54 km. Output dc voltage and power, input RF power, efficiency, and operating temperatures were obtained for a variety of dc load and RF incident power levels at 2388 MHz. Incident peak RF intensities of up to 170 mW/sq cm yielded up to 30.4 kW of dc output power. The highest derived collection-conversion efficiency of the array was greater than 80 percent. Author

N76-11208*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
IN-FLIGHT CALIBRATION OF THE HIGH-GAIN ANTENNA POINTING FOR THE MARINER VENUS-MERCURY 1973 SPACECRAFT
J. M. Hardman, W. F. Havens, and H. Ohtakay 15 Oct. 1975 35 p refs
(Contract NAS7-100)
(NASA-CR-145624; JPL-TM-33-740) Avail: NTIS HC $4.00 CSCL 22B

The methods used to in-flight calibrate the pointing direction of the Mariner Venus-Mercury 1973 spacecraft high gain antenna and the achieved antenna pointing accuracy are described. The overall pointing calibration was accomplished by performing calibration sequences at a number of points along the spacecraft trajectory. Each of these consisted of articulating the antenna about the expected spacecraft-earth vector to determine systematic pointing errors. The high gain antenna pointing system, the error model used in the calibration, and the calibration and pointing strategy and results are discussed. Author

N76-11209# European Space Agency, Paris (France).
OPTIMIZATION OF THE ASCENT TRAJECTORY OF A 4-STAGE LAUNCHING VEHICLE FOR GEOSYNCHRONOUS MISSIONS
Wolfgang Duffek et al Jul. 1975 194 p refs Transl. into ENGLISH of "Optimierung der Aufstiegsbahn eines 4-stufigen Traegers fuer Synchronbahn-Missionen", DFVLR, Oberpfaffenhofen, West Ger. Report DLR-FB-75-04, 1975 Original German report available from DFVLR, Porz, West Ger.56-60 DM
(ESA-TT-180; DLR-FB-75-04) Avail: NTIS HC $7.50

In connection with the geosynchronous mission of the German-French communication satellite Symphonie, the ascent trajectories of the Europa 2 vehicle, which was first developed for this mission, were studied. A nominal nearly geosynchronous primary orbit studied was used as target orbit. The investigated trajectory to this primary orbit consists of 5 thrust phases and 2 coast phases. The mathematical model for the vehicle considers all essential effects. The controls are determined such that the mass delivered in the primary orbit attains a maximum. This optimization problem was formulated as a boundary value problem with parameter optimization in an inner loop and was solved by the multiple shooting method. Initially optimal ascent trajectories for the nominal vehicle with fixed mass balance are given. The effect of a change in the staging ratio of the 4th stage on the increase of payload was investigated. The influence of given technical and operational constraints on the payoff function was determined. Author (ESA)

N76-11927 Joint Publications Research Service, Arlington, Va.
LAUNCHINGS OF SPACE VEHICLES IN THE USSR IN 1974
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 123-125 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 3 p (For availability see N76-11919 02-88)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N76-11210*# Martin Marietta Corp., Denver, Colo.
INTEGRATED ORBITAL SERVICING STUDY FOR LOW-COST PAYLOAD PROGRAMS. VOLUME 1: EXECUTIVE SUMMARY Final Report
W. L. DeRocher, Jr. Sep. 1975 56 p
(Contract NAS8-30820)
(NASA-CR-144050; MCR-75-310-Vol-1) Avail: NTIS HC $4.50 CSCL 22B

Various operating methodologies to achieve low-cost space operations were investigated as part of the Space Transportation System (STS) planning. The emphasis was to show that the development investment, initial fleet costs, and supporting facilities for the STS could be effectively offset by exploiting the capabilities of the STS to satisfy mission requirements and reduce the cost of payload programs. The following major conclusions were reached: (1) the development of an on-orbit servicer maintenance system is compatible with many spacecraft programs and is recommended as the most cost-effective system, (2) spacecraft can be designed to be serviceable with acceptable design, weight, volume, and cost effects, (3) use of on-orbit servicing over a 12 year period results in savings ranging between four and nine billion dollars, (4) the pivoting arm on-orbit servicer was selected and a preliminary design was prepared, (5) orbital maintenance has no significant impact on the STS. Author

N76-11211*# Martin Marietta Corp., Denver, Colo.
INTEGRATED ORBITAL SERVICING STUDY FOR LOW-COST PAYLOAD PROGRAMS. VOLUME 2: TECHNICAL AND COST ANALYSIS
E. R. Cody, C. L. Deats, W. L. Derocher, Jr., G. M. Kyrias, M. R. Snodgrass, R. D. Sosnay, R. A. Spencer, and A. E. Wudell Sep. 1975 377 p refs
(Contract NAS8-30820)
(NASA-CR-144051; MCR-75-310-Vol-2) Avail: NTIS HC $10.75 CSCL 22B

Orbital maintenance concepts were examined in an effort to determine a cost effective orbital maintenance system compatible with the space transportation system. An on-orbit servicer maintenance system is recommended as the most cost effective system. A pivoting arm on-orbit servicer was selected and a preliminary design was prepared. It is indicated that orbital maintenance does not have any significant impact on the space transportation system. J.M.S.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N76-11212*# Alabama A & M Univ., Huntsville. School of Technology.
DESIGN STUDY OF A HEAO-C SPREAD SPECTRUM TRANSPONDER TELEMETRY SYSTEM FOR USE WITH THE TDRSS SUBNET Final Report
Glenn Weathers 30 Sep. 1975 197 p
(Grant NsG-8013)
(NASA-CR-145644) Avail: NTIS HC $7.50 CSCL 17B

The results of a design study of a spread spectrum transponder for use on the HEAO-C satellite were given. The transponder performs the functions of code turn-around for ground range and range-rate determination, ground command receiver, and telemetry data transmitter. The spacecraft transponder and associated communication system components will allow the HEAO-C satellite to utilize the Tracking and Data Relay Satellite System (TDRSS) subnet of the post 1978 STDN. The following areas were discussed in the report: TDRSS Subnet Description, TDRSS-HEAO-C System Configuration, Gold Code Generator, Convolutional Encoder Design and Decoder Algorithm, High Speed Sequence Generators, Statistical Evaluation of Candidate Code Sequences using Amplitude and Phase Moments, Code and Carrier Phase Lock Loops, Total Spread Spectrum Transponder System, and Reference Literature Search. Author

N76-11213# General Research Corp., McLean, Va.
SPACE OBJECT LASER ANALYSIS: 2 (SOLA) Final Technical Report
G. F. Gurski, W. N. Peters, R. J. Radley, Jr., and N. H. Schultz May 1975 246 p refs
(Contract F30602-74-C-0119; AF Proj. 6527)
(AD-A011917; Rept-49OW-01-CR; RADC-TR-75-141) Avail: NTIS CSCL 17/5

The object of this study was to definitize conceptual descriptions of laser radar functions identified during the original SOLA study. The work reported here is a compilation of analyses performed on individual study tasks including: quasi-resolved target effects, satellite laser radar cross-section modeling, signature effects on detection probability, CORAL (Coherent Optical Radar Laboratory) aquisition software, and multi-sensor SOI (Space Object Identification). GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-11214*# Calspan Corp., Buffalo, N.Y.
TRANSONIC WIND TUNNEL TESTS OF A.015 SCALE SPACE SHUTTLE ORBITER MODEL, VOLUME 1 Final Report
N. A. Struzynski Aug. 1975 698 p refs
(Contract NAS9-14752)
(NASA-CR-144546; AA-4018-W-13-Vol-1) Avail: NTIS HC $16.25 CSCL 22B

Transonic wind tunnel tests were run on a 0.015 scale model of the Space Shuttle Orbiter Vehicle in an eight-foot tunnel during August 1975. The purpose of the program was to obtain basic shuttle aerodynamic data through a full range of elevon and aileron deflections, verification of data obtained at other facilities, and effects of Reynolds numbers. The first part of a discussion of test procedures and results in both tabular and graphical form were presented. Tests were performed at Mach numbers from 0.35 to 1.20, and at Reynolds numbers for 3.5 million to 8.2 million per foot. The angle of attack was varied from -1 to +20 degrees at sideslip angles of -2, 0, +2 degrees. Sideslip was varied from -6 to +8 degrees at constant angles of attack from 0 to +20 degrees. Various aileron and ailevon settings were tested for various angles of attack. Author

N76-11215*# Calspan Corp., Buffalo, N.Y.
TRANSONIC WIND TUNNEL TESTS OF A .015 SCALE SPACE SHUTTLE ORBITER MODEL, VOLUME 2 Final Report

N. A. Struzynski Aug. 1975 384 p
(Contract NAS9-14752)
(NASA-CR-144547; AA-4018-W-13-Vol-2) Avail: NTIS HC $10.50 CSCL 22B

Transonic wind tunnel tests were run on a 0.015 scale model of the Space Shuttle Orbiter Vehicle in an eight-foot tunnel during August 1975. The purpose of the program was to obtain basic shuttle aerodynamic data through a full range of elevon and aileron deflections, verification of data obtained at other facilities, and effects of Reynolds numbers. The second part of a discussion of test procedures and results in both tabular and graphical form were presented. Tests were performed at Mach numbers from 0.35 to 1.20, and at Reynolds numbers from 3.5 million to 8.2 million per foot. The angle of attack was varied from -2 to +20 degrees at sideslip angles of -2, 0, +2 degrees. Sideslip was varied from -6 to +8 degrees at constant angles of attack from 0 to +20 degrees. Various aileron and ailevon settings were tested for various angles of attack. Author

N76-11216*# Howard Univ., Washington, D.C. School of Engineering.
THE DYNAMICS OF SPIN STABILIZED SPACECRAFT WITH MOVABLE APPENDAGES, PART 2 Semiannual Status Report, 16 May - 15 Nov. 1975
Peter M. Bainum and R. Sellappan 15 Nov. 1975 26 p refs
(Grant NsG-1181)
(NASA-CR-145605) Avail: NTIS HC $4.00 CSCL 22B

Research efforts on various methods that employ moving external parts for spacecraft control are presented. Two basic types of appendages were considered: (1) a hinged type, and (2) a telescoping type. Procedures for evaluating each type of appendage are listed, and control laws and equations of motion for each type are also discussed. Illustrations of the different types of appendages are shown. J.R.T.

N76-11217*# General Dynamics/Convair, San Diego, Calif.
FUTURE PAYLOAD TECHNOLOGY REQUIREMENTS STUDY Final Report
Jun. 1975 508 p refs Prepared in cooperation with Rockwell Intern., Downey, Calif. and G. E., Philadelphia
(Contract NAS2-8272)
(NASA-CR-137773; CASD-NAS-75-004) Avail: NTIS HC $12.75 CSCL 22B

Technology advances needed for an overall mission model standpoint as well as those for individual shuttle payloads are defined. The technology advances relate to the mission scientific equipment, spacecraft subsystems that functionally support this equipment, and other payload-related equipment, software, and environment necessary to meet broad program objectives. In the interest of obtaining commonality of requirements, the study was structured according to technology categories rather than in terms of individual payloads. Author

N76-11218*# Martin Marietta Corp., Denver, Colo.
A STUDY TO DEFINE AN IN-FLIGHT DYNAMICS MEASUREMENT AND DATA APPLICATIONS PROGRAM FOR SPACE SHUTTLE PAYLOADS Final Report
W. Paul Rader, Stanley Barrett, and Kenneth R. Payne Nov. 1975 229 p ref
(Contract NAS1-13377)
(NASA-CR-144892; MCR-75-444) Avail: NTIS HC $8.00 CSCL 22B

Data measurement and interpretation techniques were defined for application to the first few space shuttle flights, so that the dynamic environment could be sufficiently well established to be used to reduce the cost of future payloads through more efficient design and environmental test techniques. It was concluded that: (1) initial payloads must be given comprehensive instrumentation coverage to obtain detailed definition of acoustics, vibration, and interface loads, (2) analytical models of selected initial payloads must be developed and verified by modal surveys and flight measurements, (3) acoustic tests should be performed on initial payloads to establish realistic test criteria for components and experiments in order to minimize unrealistic failures and retest requirements, (4) permanent data banks should be set up to establish statistical confidence in the data to be used, (5) a more unified design/test specification philosophy is needed, (6) additional work is needed to establish a practical testing technique for simulation of vehicle transients. Author

N76-11219*# California Univ., Los Angeles. School of Engineering and Applied Science.
A STUDY OF ATTITUDE CONTROL CONCEPTS FOR PRECISION-POINTING NON-RIGID SPACECRAFT Final Report
Peter W. Likins Washington NASA Oct. 1975 163 p ref
(Contract NAS8-28358)
(NASA-CR-2619) Avail: NTIS HC $6.75 CSCL 22B

Attitude control concepts for use onboard structurally nonrigid spacecraft that must be pointed with great precision are examined. The task of determining the eigenproperties of a system of linear time-invariant equations (in terms of hybrid coordinates) representing the attitude motion of a flexible spacecraft is discussed. Literal characteristics are developed for the associated eigenvalues and eigenvectors of the system. A method is presented for determining the poles and zeros of the transfer function describing the attitude dynamics of a flexible spacecraft characterized by hybrid coordinate equations. Alterations are made to linear regulator and observer theory to accommodate modeling errors. The results show that a model error vector, which evolves from an error system, can be added to a reduced system model, estimated by an observer, and used by the control law to render the system less sensitive to uncertain magnitudes and phase relations of truncated modes and external disturbance effects. A hybrid coordinate formulation using the provided assumed mode shapes, rather than incorporating the usual finite element approach is provided. Author

N76-11220*# California Univ., Los Angeles.
GRAVITATIONAL FORCES AND MOMENTS ON SPACECRAFT
T. R. Kane and P. W. Likins Washington NASA Oct. 1975 147 p refs
(Contract NAS8-28358)
(NASA-CR-2618) Avail: NTIS HC $6.00 CSCL 22B

The solution of problems of attitude dynamics of spacecraft and the influence of gravitational forces and moments is examined. Arguments are presented based on Newton's law of gravitation, and employing the methods of Newtonian (vectorial) mechanics, with minimal recourse to the classical concepts of potential theory. The necessary ideas were developed and relationships were established to permit the representation of gravitational forces and moments exerted on bodies in space by other bodies, both in terms involving the mass distribution properties of the bodies, and in terms of vector operations on those scalar functions classically described as gravitational potential functions. Author

N76-11221*# Martin Marietta Aerospace, Denver, Colo.
COMPUTERIZED OPTIMIZATION OF ELASTIC BOOSTER AUTOPILOTS. VOLUME 1: TECHNICAL MANUAL
Tim Kelley, Charles Murrish, and Glen Szollosi Aug. 1975 174 p refs
(Contract NAS8-30808)
(NASA-CR-144026; MCR-75-322-Vol-1) Avail: NTIS HC $6.75 CSCL 22B

The philosophy and the mathematical basis of the nonlinear programming algorithm underlying the development of the COEBRA program were given. A User's Manual was given in a separate document. The purpose of this work was to convert the COEBRA program from the CDC 6400/6500 digital computer system to the UNIVAC 1108 at the George C. Marshall Space Flight Center and to provide an instruction manual on the use of the program. Author

N76-11222*# Martin Marietta Corp., Denver, Colo.
EXPERIMENTAL STUDY OF TRANSIENT LIQUID MOTION IN ORBITING SPACECRAFT Interim Report, Mar. 1974 - Feb. 1975
Robert L. Berry and James R. Tegart Feb. 1975 89 p refs
(Contract NAS8-30690)
(NASA-CR-144003; MCR-75-4) Avail: NTIS HC $5.00 CSCL 22B

The results are presented of a twofold study of transient liquid motion such as that which will be experienced during orbital maneuvers by space tug. A test program was conducted

in a low-g test facility involving twenty-two drops. Biaxial, low-g accelerations were applied to an instrumented, model propellant tank during free-fall testing, and forces exerted during liquid reorientation were measured and recorded. Photographic records of the liquid reorientation were also made. The test data were used to verify a mechanical analog which portrays the liquid as a point mass moving on an ellipsoidal constraint surface. The mechanical analog was coded into a FORTRAN IV digital computer program: LAMPS, Large AMPlitude Slosh. Test/analytical correlation indicates that the mechanical analog is capable of predicting the overall force trends measured during testing.
Author

N76-11223*# Chrysler Corp., New Orleans, La. Space Div.
AN INVESTIGATION IN THE NASA MSFC 14-INCH TRISONIC WIND TUNNEL TO DETERMINE THE PRESSURE DISTRIBUTION OVER THE COMPONENTS OF A 0.004 SCALE VERSION OF THE ROCKWELL MCR 0074 BASELINE SHUTTLE ASCENT CONFIGURATION, VOLUME 1
Paul E. Ramsey (NASA. Marshall Space Flight Center) Sep. 1975 834 p refs
(Contract NAS9-13247)
(NASA-CR-141807; DMS-DR-2027-Vol-1) Avail: NTIS HC $21.25 CSCL 22B

Data were obtained for Mach numbers from 0.6 to 3.48, angles of attack from -10 to 10 degrees, and angles of sideslip from -10 to 10 degrees at zero angle of attack. Also, -4 and 4 degrees sideslip were run for an angle of attack of -5 and 5 degrees. Aerodynamic configurations of the solid rocket motors, external tank, and orbiter are shown. Graphs of plotted pressure data (pressure coefficients) for the external tank and solid rocket motors are given. A description of the test facility is included.
Author

N76-11224*# Chrysler Corp., New Orleans, La. Space Div.
AN INVESTIGATION IN THE NASA MSFC 14-INCH TRISONIC WIND TUNNEL TO DETERMINE THE PRESSURE DISTRIBUTION OVER THE COMPONENTS OF A 0.004 SCALE VERSION OF THE ROCKWELL MCR 0074 BASELINE SHUTTLE ASCENT CONFIGURATION (IA32F), VOLUME 2
Paul E. Ramsey (NASA. Marshall Space Flight Center) Sep. 1975 704 p refs
(Contract NAS9-13247)
(NASA-CR-141808; DMS-DR-2027-Vol-2) Avail: NTIS HC $18.75 CSCL 22B
For abstract, see N76-11223.

N76-11225*# Chrysler Corp., New Orleans, La. Space Div.
AN INVESTIGATION IN THE NASA MSFC 14-INCH TRISONIC WIND TUNNEL TO DETERMINE THE PRESSURE DISTRIBUTION OVER THE COMPONENTS OF A 0.004 SCALE VERSION OF THE ROCKWELL MCR 0074 BASELINE SHUTTLE ASCENT CONFIGURATION (IA32F), VOLUME 3
Paul E. Ramsey (NASA). Marshall Space Flight Center) Sep. 1975 769 p refs
(Contract NAS9-13247)
(NASA-CR-141809; DMS-DR-2027-Vol-3) Avail: NTIS HC $18.75 CSCL 22B
For abstract, see N76-11223.

N76-11226# Royal Aircraft Establishment, Farnborough (England).
A CONING ANGLE SENSOR FOR SPIN STABILIZED SPACECRAFT
A. K. Brookman and P. G. Earwicker Feb. 1975 18 p
(RAE-TR-75011; BR46618) Avail: NTIS HC $3.50

A sensor which measures the spin axis direction of a spin-stabilized satellite, using the sun as an external reference, was described. The theory of the sensor was presented, together with some analysis of the effects of errors in the principal parameters. Results for a prototype sensor were discussed. It was concluded that they are generally satisfactory, but that a proper assessment cannot be made due to test gear limitations; the performance of the sun simulator was especially inadequate.
Author (ESA)

N76-11227# Istituto per le Ricerche di Tecnologia Meccanica, Torino (Italy).
DETAILED INVESTIGATION OF THE RESONANCE EFFECTS ON THE VIBRATION MODES OF A CABLE BOOM Final Report
G. Fontana Apr. 1975 117 p refs
(Contract ESTEC-2193/74-SK)
(ESA-CR(P)-666) Avail: NTIS HC $5.50

Two types of cable, a BAC ribbon cable, and a HABIA cable with gold kapton tape, were subjected to tests to determine resonance modes and amplification factors for separate mechanical (x and y flexural, and torsional), and thermal excitations both in air and vacuum. A strong tendency to static twist as a result of constant illumination in vacuum was experienced for the HABIA cable. Since the time constant of this effect is long, 1 hour, it should not be important for cable boom dynamics. Apart from the twist effect no notable influence of testing in vacuum as opposed to air was experienced which implies that testing in air should be satisfactory for these tests. Previous test results on the BAC cables were confirmed.
ESA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-11228# Danish Meteorological Inst., Copenhagen.
EJECTABLE TELESCOPE ARM FOR ROCKET PROTON PRECESSION MAGNETOMETER SENSOR
F. Primdahl, M. Genevey, and T. Langhoff 1975 25 p refs
(R-42) Avail: NTIS HC $3.50 CSCL 22B

A pneumatic telescopic arm for extending a proton precession magnetometer sensing coil approximately one meter above the top of the payload was constructed and tested. The telescopic arm is mounted inside an ejectable nose cone which is shot off by air pressure some tens of seconds after launch. The sensor coil is then released fron the top deck, and the outer tube from the arm and the coil are lifted by air pressure until the outer tube locks to the top of the inner tube. The coil proceeds by force of inertia to the top of the outer tube where the cones lock. The extended arm was analyzed with respect to mechanical stress and vibration and this was followed by laboratory tests. Two flight tests were made. Radio signals from these flights indicated that the arm performed as intended.
Y.J.A.

N76-11229# Endl (Kurt), Biebertal (West Germany).
OBLIQUE ALBEDO-SENSOR MEASUREMENTS
K. Endl Paris ESA Sep. 1975 76 p
(Contract ESOC-367/71)
(ESA-CR(P)-345) Avail: NTIS HC $5.00

The spin-axis vector of a spinning satellite can be determined by means of attitude-measuring systems that use the sun and the earth's albedo as references. An albedo sensor consists of a narrow slit mounted at a certain inclination angle with respect to the spacecraft's equatorial plane. The sensor triggers as soon as the illuminated part of the earth enters or leaves its field of view. There are three cases: (1) the sensor is triggered by the illuminated part of the earth limb, (2) the sensor is triggered by the earth terminator; and (3) the sensor is triggered by an edge of the albedo. A mathematical theory is presented that, on the basis of given measurements, enables a decision to be made concerning which of the three cases is applicable to a particular triggering. An example of the calculation of the spin-axis vector is given.
Author (ESA)

N76-11230# Cambridge Consultants Ltd. (England).
NON-MECHANICALLY TUNED OPTICAL BANDPASS FILTERS. A SURVEY AND ASSESSMENT Final Report
J. P. Auton, M. J. Brookfield, and J. A. Dawson Apr. 1975 170 p refs
(Contract ESTEC-2275/74-PP)
(CCL-C1011; ESA-CR(P)-664) Avail: NTIS HC $6.75

A survey and an assessment of the possibilities of changing the passband of a spectral filter by nonmechanical means and by external command is presented. Such a tunable filter could be used in earth resources surveys and atmospheric temperature

sounding. Types of filters discussed are: Fabry-Perot, liquid crystal interference, acousto-optic, thermally tuned Christiansen, electro-optic polarization, thermally tuned Lyst, and switchable liquid crystal. It is concluded that for the visible region and up to about 1 micron, a polarization filter employing an electro-optically tuned liquid crystal as the birefringent materials shows the greatest promise. In the infrared region the tunable Fabry-Perot filter is by far the most promising. ESA

N76-11231# Honeywell, Inc., Minneapolis, Minn.
CADMIUM SULFIDE AND CADMIUM SELENIDE STAR DETECTOR PARAMETRIC ANALYSIS Final Report, 2 May 1972 - 31 Jan. 1975
W. W. Doerffler, J. O. Boutelle, J. Jurisson, B. Gupta, and K. Tien 31 Jan. 1975 357 p
(Contract F04701-72-C-0292)
(AD-A011777; F0137-FR1; SAMSO-TR-75-68) Avail: NTIS CSCL 17/7

The parametric analysis of CdS and CdSe star detectors concentrates on functional relationships between detector performance and parameters such as materials properties, detector geometry, star image size and quality, total power of star light on the detector, star image transit rate, color temperature of the simulated star, and bias light. The parametric analysis was conducted to develop a better understanding of the detector performances as related to SPARS (Space Precision Attitude Reference System) and HAARS (High Altitude Attitude Reference System) requirements and, furthermore, to learn the entire operational ranges of CdS and CdSe star detector performances so that other related mission applications can benefit. GRA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-11232*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering.
THE 3.3K THRUST CHAMBER LIFE PREDICTION
W. H. Armstrong 1 Aug. 1974 80 p refs
(Contract NAS8-30615)
(NASA-CR-144048; D180-18170-1) Avail: NTIS HC $5.00 CSCL 12H

The cause of low-cycle fatigue failure of the 3.3K Thrust Chamber was investigated. This thrust chamber typifies the current trend in rocket nozzle design which calls for high performance coupled with weight and volume limitations as well as the requirement of reusability. The analysis was performed with the BOPACE finite-element computer program which provides capability to determine viscoplastic response of a structure subjected to cyclic thermal and mechanical loading. Results are presented which show the critical region for low-cycle fatigue and the history of strain within that region for each thermo-mechanical loading cycle in the 3.3K thrust chamber. The predicted behavior was used to evaluate the low-cycle fatigue life near the throat plane of the chamber. The results show that BOPACE provides an extremely accurate prediction of structural behavior; the critical region was identified and the life determined from computed strains was within 154 cycles of the observed failure at 1013 cycles. Author

N76-11233*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID ROCKET TECHNOLOGY ADVANCEMENTS FOR SPACE TUG AND IUS APPLICATIONS
W. Ascher, R. L. Bailey, J. W. Behm, and W. Gin 15 Oct. 1975 28 p refs
(Contract NAS7-100)
(NASA-CR-145561; JPL-TM-33-746) Avail: NTIS HC $4.00 CSCL 21H

In order for the shuttle tug or interim upper stage (IUS) to capture all the missions in the current mission model for the tug and the IUS, an auxiliary or kick stage, using a solid propellant rocket motor, is required. Two solid propellant rocket motor technology concepts are described. One concept, called the 'advanced propulsion module' motor, is an 1800-kg, high-mass-fraction motor, which is single-burn and contains Class 2 propellent. The other concept, called the high energy upper stage restartable solid, is a two-burn (stop-restartable on command) motor which at present contains 1400 kg of Class 7 propellant. The details and status of the motor design and component and motor test results to date are presented, along with the schedule for future work. Author

N76-11234# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
RESEARCH ON THE ANALYSIS OF NUCLEAR SPACECRAFT AND SPECIAL NUCLEAR REACTOR APPLICATIONS Semiannual Progress Report, 1 Jul. - 31 Dec. 1974
J. S. Greenberg and J. P. Layton 15 Jan. 1975 40 p refs
(Contract AT(11-1)-2393)
(COO-2393-17; AMS-1215) Avail: NTIS MF $5.00

The performance, reliability, and economics of nuclear powered spacecraft and nuclear power systems for geocentric missions are analyzed. Reactors such as Uranium Zirconium Hydride thermal reactors and fast reactors with UO2, UC, UN, and other fuels applicable in space and aeronautical flight regimes are included. Author (NSA)

N76-11235# European Space Agency, Paris (France).
DEVELOPMENT OF A PLASMA ABLATION ACCELERATOR FOR SATELLITE ATTITUDE CONTROL
Bela Kazinczy et al Jun. 1975 67 p refs Transl. into ENGLISH of "Weiterentwicklung eines Plasma-Ablations-Triebwerkes fuer Lageregelung von Satelliten", DFVLR, Stuttgart Report DLR-FB-75-22, 28 Jan. 1975 Original German report available from DFVLR, Porz, West Ger. 27.40 DM
(ESA-TT-167; DLR-FB-75-22) Avail: NTIS HC $4.50

On the basis of an electron pressure accelerating mechanism, a prototype accelerator was built. The development of this prototype-accelerator on a technical stand which would allow a space qualification procedure of the accelerator is described. The development consisted of two major parts: selection and investigation of fuel materials and the mechanical design of the accelerator. Optimal fuel materials and an adequate mechanical design were found which resulted in an accelerator efficiency which is relatively high in so far as micro-thrusters are concerned. Author (ESA)

N76-11236# European Space Agency, Paris (France).
RESEARCH ON THE ENERGY CONVERSION IN LIQUID ROCKETS IN CONNECTION WITH THRUST CONTROL
Winfried Buschulte Aug. 1975 234 p refs Transl. into ENGLISH of "Untersuch. ueber die Energieumsetzung in Fluessigkeitsraketen im Zusammenhang mit Schubregelung", DFVFB, Lampoldshausen, West Ger. Report DLR-FB-73-79, 8 Jun. 1973 Original German report available from DFVLR, Porz, West Ger. 35.50 DM
(ESA-TT-182; DLR-FB-73-79) Avail: NTIS HC $8.00

The range of thrust variation necessary was deduced from some mission examples. To find the optimal flight path of satellite launchers, a diagram was made. Systems for determining the injector element sprays droplet diameter distributions and evaporation efficiency are explained. Suggestions are made for improving the predictability of mixing efficiencies of elements. An injector type and its performance are discussed. Effects of thrust control on the expansion process are dealt with. Test results from a CH2/LOX-throttleable rocket engine are presented and compared with theoretical results of the process study. Author (ESA)

N76-11237# European Space Agency, Paris (France).
METHODS FOR APPROXIMATE OPTIMUM THRUST PROGRAMMING OF SOLID PROPELLANT ROCKETS FOR SPACECRAFT APPLICATIONS
Walter Helmut Diesinger Sep. 1975 244 p refs Transl. into ENGLISH of "Methoden der angenaeherten Verwirklichung optimaler Schubprogramme von Feststoffraketen fuer die Raumfahrt", Rheinisch-Westfael. Tech. Hochschule, Aachen Report DLR-FB-75-31, 17 Feb. 1975 Original German report available from DFVLR, Porz, West Ger. 99.40 DM

(ESA-TT-186; DLR-FB-75-31) Avail: NTIS HC $8.00

The characteristics of an optimum thrust program depending on the individual mission of a spacecraft propulsion system and the present state-of-art of realization are discussed. Results of additional theoretical and experimental investigations are presented which confirm that arbitrary at least near-optimum thrust profiles may be realized with solid propellant rockets. In practice, however, overall optimization calls for a compromise between thrust program, structure weight, cost effectiveness, and reliability. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N76-11238*# Scientific Translation Service, Santa Barbara, Calif.
PREPARATION AND PROPERTIES OF HYDROGEN POLYSULFIDES OF ORGANIC BASES
H. Krebs, E. F. Weber, and H. Balters Washington NASA Nov. 1975 11 p refs Transl. into ENGLISH from Z. Anorg. Allg. Chem. (Leipzig), v. 275, 1954 p 147-151
(Contract NASw-2791)
(NASA-TT-F-16659) Avail: NTIS HC $3.50 CSCL 07C

Hydrogen polysulfides of even highly volatile amines can be prepared conveniently if one dissolves the amine and sulfur in solvents which are as non-polar as possible and slowly introduces hydrogen sulfide. The results are generally not the acid but the neutral hydrogen polysulfides with seven or nine sulfur atoms. Author

N76-11239*# Scientific Translation Service, Santa Barbara, Calif.
PREPARATION AND PROPERTIES OF HYDROGEN POLYSULFIDES OF ORGANIC BASES, 2
H. Krebs and K.-H. Mueller Washington NASA Nov. 1975 8 p refs Transl. into ENGLISH from Z. Anorg. Allg. Chem. (Leipzig), v. 281 , 1955 p 187-189
(Contract NASw-2791)
(NASA-TT-F-16660) Avail: NTIS HC $3.50 CSCL 07C

Hydrogen polysulfides of long chain diamines, (CH2)n(NH3)2xSx, can be formed conveniently in aqueous medium, in beautiful crystals, in analogy to the ammonium polysulfides. The dimensions of the elementary cells and the lattice symmetries of some compounds are reported. Author

N76-11240*# Transemantics, Inc., Washington, D.C.
A NEW FULMINIC ACID SYNTHESIS. ON THE NATURE OF FULMINIC ACID FORMATION FROM ALCOHOL AND NITRIC ACID
Heinrich Wieland Washington NASA Nov. 1975 10 p refs Transl. into ENGLISH from Chem. Ber. (West Germany), v. 40, 1907 p 418-422
(Contract NASw-2792)
(NASA-TT-F-16680) Avail: NTIS HC $3.50 CSCL 07C

The decomposition of methyl nitrolic acid was studied. It was found that the compound broke down chiefly into formic acid and nitrous acid, but that fulminc acid was also obtained in relatively significant amounts. The acid was best obtained in the form of its silver or mercury salt. If the methyl nitrolic acid is decomposed in a slightly nitric solution of 0.5 g pure pitrolic acid in 4 ccm of water mixed with 1 ccm of 30 percent nitric acid, with a 10 percent silver nitrate solution, 0.25 g of silver fulminate are obtained, or about 30 percent of the theoretical yield. This formation of fulminic acid explains the nature of fulminic acid synthesis from alcohol and nitric acid, which leads from ethyl alcohol to acetaldehyde, which permits the appearance of nitrogen-containing groups. As the aldehyde group is oxidized further, the isonitroso compound transforms into nitrolic acid. Author

N76-11241*# Transemantics, Inc., Washington, D.C.
ACTION OF HYDROXYLAMINE ON THE IMIDE ETHER AND ON AMIDINES: ACIDOXIMES
A. Pinner Washington NASA Nov. 1975 7 p Transl. into ENGLISH from Chem. Ber. (West Germany), v. 17, 1884 p 184-186
(Contract NASw-2792)
(NASA-TT-F-16689) Avail: NTIS HC $3.50 CSCL 07C

Attempts made to determine whether the labile imide group of the imide ether and amidine could be transformed by hydroxylomine into the oximide group are reported. The procedure first creates oximide ether and oxamidine and through careful saponification of the ether, the acids are extracted. Author

N76-11242*# Transemantics, Inc., Washington, D.C.
ON THE CONDENSATION OF PHENYLNITROMETHANE WITH BENZALDEHYDE: ON CIS- AND TRANS-7-NITRO STILBENE
Friedrich Heim Washington NASA Nov. 1975 11 p refs Transl. into ENGLISH from Chem. Ber. (West Germany), v. 44, 1911 p 2016-2022
(Contract NASw-2792)
(NASA-TT-F-16688) Avail: NTIS HC $3.50 CSCL 07C

Benzaldehyde and phenylnitromethane were condensed using aliphatic bases and obtained 7-nitro stilbene (benzylide phenyl nitromethant) at melting point 75 deg with a yield of 60 to 70 percent of the theory. In addition to the pale yellow 7-nitro stilbene which boils fully at 75 deg, an amount to 7 to 10 percent of a dark yellow substance which takes on a greenish yellow tint when exposed to light was obtained, whose compact crystals differ in appearance from the long needles of the former, and whose boiling point lies around 128 to 128.5 deg. According to the analysis, the substance has the same composition, C14H11O2N, as that of 7-nitro stilbene (75 deg). Author

N76-11243*# Transemantics, Inc., Washington, D.C.
ON AMIDOXIMES AND AZOXIMES
Ferdinand Tiemann and Paul Kruger Washington NASA Nov. 1975 22 p refs Transl. into ENGLISH from Chem. Ber. (West Germany), v. 17, 1882 p 1685-1698
(Contract NASw-2792)
(NASA-TT-F-16681) Avail: NTIS HC $3.50 CSCL 07C

Mandelic acid nitrile, like benzontrile, combines with hydroxylamine. The resulting substances demonstrate the characteristics of amido acids since they can be bound with acids as well as with bases. The experiments described were conducted to determine whether the compounds obtained from the action of hydroxylamine on acid nitrile are to be included in one class or the other. Author

N76-11244# Advisory Group for Aerospace Research and Development, Paris (France).
HIGH TEMPERATURE CORROSION OF AEROSPACE ALLOYS
John F. Stringer (Liverpool Univ.) Aug. 1975 607 p refs (AGARD-AG-200; AGARDograph-200) Avail: NTIS HC $16.25

Information contained in various places in the technical literature, in government and other similar reports, and information not yet published was gathered for inclusion in a comprehensive publication. Summary information is presented on oxidation rates, diffusion, reaction kinetics, engineering information on practical alloys, and tests under simulated service conditions. Data on phase diagrams, diffusion information and thermodynamic information are included along with data on superalloys and refractory metals. For individual titles, see N76-11245 through N76-11250.

N76-11245 Advisory Group for Aerospace Research and Development, Paris (France).
BASIC DATA **c26**
In its High Temperature Corrosion of Aerospace Alloys Aug. 1975 p 1-26 refs (For availability see N76-11244 02-23)

Data, listed in tabular form for metal oxides and spinels, is presented. Specifically covered in the data are: (1) crystal structure; (2) melting and boiling points; (3) equilibrium pressures (ATM); (4) mechanical properties; (5) color descriptions, and (6) reaction kinetics. Also included is phase diagram information for metal-oxygen systems, metal sulphur systems, and systems involving oxides, chlorides, and sulphates. J.R.T.

N76-11246 Advisory Group for Aerospace Research and Development, Paris (France).

PREDOMINANCE DIAGRAMS c26
In its High Temperature Corrosion of Aerospace Alloys Aug. 1975 p 27-36 refs (For availability see N76-11244 02-23)

A number of predominance phase diagrams which show thermochemical information relating to the stability of phases in a convenient graphical representation are presented. Solid and liquid phases are assumed to be at unit activity. Author

N76-11247 Advisory Group for Aerospace Research and Development, Paris (France).
CONSTITUTION OF THE ATMOSPHERE IN THE GAS TURBINE c07
In its High Temperature Corrosion of Aerospace Alloys Aug. 1975 p 37-39 (For availability see N76-11244 02-23)

A typical marine diesel fuel was burned in the turbine. The SO3/SO2 ratio as a function of the fuel-to-air ratio (FAR) is shown; the air inlet temperature to the combustor was assumed to be 600 F. The equilibrium flame temperature, as a function of the FAR, for air inlet temperatures of 400 to 600 F is shown. The equilibrium composition of the flame gas, as a function of the FAR, is given. Actual analyses of the turbine exhausts indicated that the SO3 content was much less than that expected. The relative distribution of sulphur and sodium among their species as a function of temperature for the gas conditions is given. J.R.T.

N76-11248 Advisory Group for Aerospace Research and Development, Paris (France).
VAPOR PRESSURE AND CONDENSATION OF SODIUM SULPHATE c26
In its High Temperature Corrosion of Aerospace Alloys refs (For availability see N76-11244 02-23)

The corrosion deposits of sodium sulphate that occur on gas turbine metal alloy parts were studied. The chemical reactions occurring during high temperature corrosion are examined, and results are given for chemical analyses of various alloy specimens which were exposed to synthetic sea salt concentrations. Also included are diffusion data for various alloy combinations and the methods used to study high temperature corrosion for each alloy combination. The diffusing elements for different metallic oxides are also given. J.R.T.

N76-11249 Advisory Group for Aerospace Research and Development, Paris (France).
OXIDATION AND HOT CORROSION OF COMMERCIAL SUPERALLOYS c26
In its High Temperature Corrosion of Aerospace Alloys Aug. 1975 p 117-462 refs (For availability see N76-11244 02-23)

A summary of information on the oxidation and corrosion of 52 commercial nickel and cobalt base superalloys is presented. The composition of each alloy is given. The effects of the combustion of various sulphur-containing fuels and salt spray on alloy corrosion is examined. The results of weight analyses and chemical analyses of oxidized alloys are given. Photomicrographs of hot corrosion on turbine blades are shown. Results of thermal cycling tests are given. J.R.T.

N76-11250 Advisory Group for Aerospace Research and Development, Paris (France).
THE REFRACTORY METALS c26
In its High Temperature Corrosion of Aerospace Alloys Aug. 1975 p 463-602 refs (For availability see N76-11244 02-23)

The oxidation rates of the refractory metals, tantalum, niobium, molybdenum, and tungsten are examined. The composition of alloys of these metals is listed. The resistance of the alloys to oxidation at different temperatures, oxygen pressures, and time exposures is given. Weight changes, color changes, oxide scale thicknesses, and some mechanical properties of the alloys are given. The oxidation resistance of various alloy combinations is examined. The physical and chemical properties of molybdates are listed. J.R.T.

N76-11251# Naval Intelligence Support Center, Washington, D.C. Translation Div.
PETROLEUM LUBRICATING OILS AND OIL ADDITIVES
13 May 1975 84 p refs Transl. into ENGLISH from Neftyanye Masla i Prisadki k Nim (USSR), v. 12, 1970 p 28-58, 155-162, 210-215, 226-230, 237-240, 248-255, 320-324, 328-332 (AD-A012074; NISC-Trans-3666) Avail: NTIS CSCL 11/8

Articles on lubricating oils and additives are presented. Topics discussed include two-stage refining of lubricating fractions distilled from sour and sweet crudes with phenol, refining the lubricating fractions of parafinic sour and sweet crude oils with phenol and furfural, continuous refining of lubricating oils in a moving absorbent layer, alkylated aromatic hydrocarbons as components of lubricating oils, industrial production of alkylphenol oil additives, synthesis of ashless and low-ash content additives on the basis of sulfonic acid and alkylphenols, low molecular polymers as viscosity index improvers, emulsifiability of oils and wearing of additives in contact with water, viscosity of mixtures of polysiloxanes with synthetic fluids of different classes, and properties of esters of neopentyl glycols. M.J.S.

24 COMPOSITE MATERIALS

Includes laminates.

N76-11252*# Aluminum Co. of America, Pittsburgh, Pa.
FEASIBILITY AND PROCESS SCALE-UP LOW COST ALUMINA FIBERS FOR ADVANCED RE-USABLE SURFACE INSULATION (RSI) Final Report
Alan Pearson 1 Oct. 1975 121 p refs
(Contract NAS3-16779)
(NASA-CR-134884) Avail: NTIS HC $5.50 CSCL 11D

The objective of this program was to establish feasibility of a process to produce low cost aluminum oxide fibers having sufficient strength, flexibility, and thermal stability for multiple re-use at temperatures to 1480 C in advanced RSI type heat shields for reentry vehicles. Using bench-scale processing apparatus, the Alcoa 'Saphiber' process was successfully modified to produce nominally 8 microns diameter polycrystalline alpha-alumina fiber. Thermal stability was demonstrated in vacuum reheating tests to 1371 C and in atmospheric reheating to 1483 C. Individual fiber properties of strength, modulus, and flexibility were not determined because of friability and short length of the fiber. Rigidized tile produced from fiber of nominally 8, 20 and 40 micron diameter had thermal conductivities significantly higher than those of RSI SiO2 or mullite at relatively low temperature but became comparable above about 1000 C. Tile densities were high due to short fiber length, especially in the coarser diameter fiber. No significant effect of fiber diameter on thermal properties could be determined form the data. Mechanical properties of tiles deteriorated as fiber diameter increased. Author

N76-11253*# Martin Marietta Aerospace, Denver, Colo.
EVALUATION OF LOW COST/HIGH TEMPERATURE INSULATION, JULY 1974 - JUNE 1975
E. L. Strauss Nov. 1975 133 p refs
(Contract NAS3-18900)
(NASA-CR-134902; MCR-75-262) Avail: NTIS HC $6.00 CSCL 11D

Six fiber products and six insulation blankets comprising silica, alumina, zirconia, mullite, and mixed ceramic systems were subjected to furnace exposures up to 500 hours at temperatures of 1000 to 1600 C and evaluated for chemical and dimensional stability and for changes in thermal conductivity. Alumina, zirconia, and mullite fibers were fabricated into reusable surface insulation (RSI) tile by water-felting and reimpregnation with ethyl silicate. Specimens were exposed to 25 thermal cycles at 1200 C and 1400 C and a pressure of 10 and 32 torr, respectively. Production costs for 930 sq m (10,000 sq ft) of blanket insulation and of alumina RSI tile were developed. Author

N76-11254*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECT OF THERMAL EXPOSURE ON THE MECHANICAL PROPERTIES OF ALUMINUM-GRAPHITE COMPOSITES
I. H. Khan Aug. 1975 34 p refs
(NASA-TM-X-62482; A-6269) Avail: NTIS HC $4.00 CSCL 11D

The mechanical properties of aluminum-graphite composites were measured at room temperature in the as-received condition,

after elevated temperature exposure and after thermal cycling. The composites were fabricated by solid-state diffusion bonding of liquid-phase Al-infiltrated Thornel 50 fibers. The results showed that the maximum longitudinal tensile strength of the as-received material was 80,000 psi, which corresponds well with the rule of mixture value. The composite strength was observed to vary widely, depending on the extent of wetting of the fibers by the aluminum. The strength of the composites in the transverse direction was generally very low, due to poor interfacial bonding. Aluminum carbide (Al4C3) formed at the surface of the fibers at temperatures greater than 500 C. Development of the carbide was shown to be diffusion-controlled and was dependent on the time and temperature used. It was shown that the tensile strength was virtually unaffected by heat-treatment up to 500 C; beyond that temperature a drastic degradation of tensile strength occurred. Thermal cycling of the composites below 500 C resulted in an observable degradation of the composite strength. Author

N76-11255# Los Alamos Scientific Lab., N.Mex.
PROCESS FOR IMPROVING THE LOW TEMPERATURE DUCTILITY OF TUNGSTEN-BASE COMPOSITES
E. G. Zukas May 1975 14 p refs
(Contract W-7405-eng-36)
(LA-5962-MS) Avail: NTIS HC $4.00

At temperatures below about 100 C, liquid-phase-sintered tungsten-base composites fail in a brittle manner because of the formation of cleavage cracks in the tungsten spheroids. Improving the ductility requires some alloying addition or treatment which would improve the ductility of these spheroids, or some method of changing the stress distribution, such as putting the surface in compression, which would reduce stress concentrations and thereby require a higher load to initiate fracture. The ductilizing process used consists of coating the composite with a ductile metal followed by heat treating at a high enough temperature to insure sufficient diffusion so that the coat and base become integral. Coats of copper, nickel, gold, and cobalt were used successfully. A possible added advantage is that the surface properties can be controlled if certain reflective properties or corrosion resistance are needed, also soldering or low temperature blazing operations are feasible. Author (NSA)

N76-11256# National Bureau of Standards, Boulder, Colo.
MATERIALS RESEARCH FOR SUPERCONDUCTING MACHINERY 3 Semiannual Technical Report, 1 Sep. 1974 - 1 Mar. 1975
Richard P. Reed, ed., Alan F. Clark, ed., and Edward C. VanReuth, ed. (ARPA) Mar. 1975 529 p refs
(ARPA Order 2569)
(AD-A012365) Avail: NTIS CSCL 11/6

The third semi-annual technical reports are collected from five subcontractors of an ARPA sponsored program on the very low temperature properties of structural materials to support the development of superconducting machinery. The program is outlined and research progress is reported. Low temperature data are presented for the elastic, tensile, fatigue, and fracture properties, thermal expansion, specific heat, thermal and magneto-thermal conductivity, electrical and magnetic properties of structural alloys. Effects of processing, and fabrication are also reported for many of the properties; weld and braze joint properties are included. Low temperature properties for composites are reviewed and limited tensile and flexure data at 4 K presented. GRA

N76-11257# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.
EVALUATION OF REINFORCED THERMOPLASTIC COMPOSITES AND ADHESIVES Final Report, 1 Apr. 1974 - 1 Feb. 1975
J. T. Hoggatt and A. D. VonVolkli Mar. 1975 100 p refs
(Contract N00019-74-C-0226)
(AD-A011407; D180-17503-3) Avail: NTIS CSCL 11/4

Kevlar-49 fabric laminates with polysulfone resin matrix were evaluated for mechanical and electrical properties and environmental resistance to explore its potential for secondary and primary aircraft structure. Investigations indicated Kevlar-49 reinforced thermoplastic laminates in general exhibited properties equivalent to laminates made with thermosetting matrices. Thermoplastic polymers with service temperatures in excess of +300 F were screened with three polymers being subjected to in-depth study. These polymers were 200P polysulfone (+325 F service), 720P polysulfone (+400 F service) and NR150A polyimide (+450 F service). Each material exhibited good property translation and thermal stability within the stated service temperature range. Processing conditions for the polymers were within the limitations of most commercial autoclaves. Polysulfone resin was evaluated as an adhesive and exhibited excellent adhesive properties for bonding stainless steel and composites. Values in excess of 4500 psi and 3400 psi were obtained at 70 F and +250 F, respectively, on stainless steel lap bond specimens. Composite-to-composite bonds produced values in excess of 8000 psi with a polysulfone adhesive. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N76-11258*# Scientific Translation Service, Santa Barbara, Calif.
HIGH SPEED LIQUID CHROMATOGRAPHY: APPLICATIONS TO PETROLEUM CHEMISTRY
Hiroyuki Hatano Washington NASA Oct. 1975 28 p refs Transl. into ENGLISH from Sekiyu Gakkaishi (Japan), v. 16, no. 11, 1973 p 887-895
(Contract NASw-2791)
(NASA-TT-F-16632) Avail: NTIS HC $4.00 CSCL 07D

The use of high speed liquid chromatography is described as the most systematic method of separation analysis. The three categories of chromatography are itemized and the future of chromatography is discussed. Author

N76-11259*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
CLUSIUS-DICKEL SEPARATIONS (CDS): A NEW LOOK AT AN OLD TECHNIQUE Final Report
Philomena G. Grodzka Sep. 1975 134 p refs
(Contract NAS8-29609)
(NASA-CR-144035; LMSC-HREC-TR-D496521) Avail: NTIS HC $6.00 CSCL 07D

The history, applications, and theoretical basis of the CDS technique are reviewed. The advantage to be realized by conduction of CDSs in low-g, space environments are deduced. The results are reported of investigations aimed at further improving CDS efficiencies by altering convective flow patterns. The question of whether multicellular flow or turbulence can introduce a new separation mechanism which would boost separation efficiencies at least an order of magnitude is considered. Results are presented and discussed. Author

N76-11260*# Athens Coll., Ala.
SOLIDIFICATION KINETICS
Ronald C. McNutt 26 Sep. 1975 13 p refs
(Contract NAS8-30561)
(NASA-CR-144025) Avail: NTIS HC $3.50 CSCL 07D

The vapor systems GeI2 and I2 and solid GeI4 were analyzed, using Raman spectroscopic techniques. The Raman bands of I2 and GeI4 were confirmed and Raman bands for GeI2 at 230 and 360 cm to the -1 power were reported. The application of the Raman techniques as a temperature probe in vapor transport kinetics was studied, and its feasibility is considered to be very good. Author

N76-11261# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
FUEL AIR EXPLOSIVES. FLAME FRONT PROPAGATION OF GAS EXPLOSIONS, PART 1 [FUEL AIR EXPLOSIVES. VLAMFRONTUITBREIDING GASEXPLOSIES, DEELVERSLAG 1]
M. Bosman and H. deGooijer 13 Jan. 1975 18 p refs In

DUTCH; ENGLISH summary
(Contract A73/KL/083-G-3372-III)
(TL-1975-3; TDCK-65976) Avail: NTIS HC $3.50

Experiments were done with methane-air mixtures in a one cubic meter explosion vessel as part of the investigations into the explosive properties of a free gas cloud. The expansion of the flame front was recorded photographically and compared with theoretically calculated values. With the mixtures used in the experiments, the flame velocity seemed to remain steady throughout the wake of the explosion, up to a maximum expansion diameter of 30 cm where measurements were taken. Author (ESA)

N76-11262# Chemical Lab. RVO-TNO, Rijswikj (Netherlands).
A SYSTEM FOR DATA ACQUISITION AND REDUCTION OF HIGH RESOLUTION PHOTOPLATE MASS SPECTRA WITH A PDP 8/1 COMPUTER
W. H. Boidin and H. A. H. Craenen Mar. 1975 72 p refs
(Contract A74/K/029)
(Rept-1975-9) Avail: NTIS HC $4.50

The system consists of an automatic microphotometer-comparator, an analog tape recorder, and a PDP 8/1 computer equipped with an A/D converter. The data reduction program PEAK, written in ASSEMBLER language (PAL 8), has as its function the calculation of the position of each peak maximum relative to the start of the photoplate scan and the computation of the intensity of each peak in the spectrum which is stored on analog magnetic tape. The program MASS, written in FORTRAN 2, is used for the selection of the perfluorokerosene reference peaks, the calculation of the exact masses of the unknown ions and the elemental compositions. Author (ESA)

N76-11263# Purdue Univ., Lafayette, Ind. Proj. SQUID Headquarters.
THE STRUCTURE OF DIFFUSION FLAMES
R. W. Bilger Jun. 1975 43 p refs Prepared by Calif. Univ., La Jolla
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-A012361; SQUID-TR-UCSD-7-PU) Avail: NTIS CSCL 21/2

The theory for the mixing and chemical reaction of two streams of fluid is developed for unsteady laminar and for turbulent flow. Only one conserved scalar is required to fully describe the mixing and various reaction models are considered including the Burke-Schumann flame sheet and shifting equilibrium. A new expression is derived for the instantaneous reaction rate of any species. New insight is obtained into the structure of the instantaneous reaction zone for both laminar and turbulent flames. Diagnostic parameters are presented for determining when various models are applicable and for what properties. GRA

N76-11264# American Physical Society, Washington, D.C.
THE ROLE OF PHYSICS IN COMBUSTION, AN APS STUDY IN TECHNICAL ASPECTS OF EFFICIENT ENERGY UTILIZATION
D. L. Hartley, D. R. Hardesty, M. Lapp, J. Dooher, and F. Dryer Jan. 1975 158 p refs Sponsored by NSF, FEA, and Elec. Power Res. Inst., Washington, D. C. Submitted for publication
(PB-242688/0) Avail: NTIS HC $6.75 CSCL 21B

Three ways in which physics research can improve the understanding of combustion are explored: (1) numerical modeling-priority is assigned to fundamental work on models of turbulence, pyrolysis, and nucleation, and to the construction of compact kinetic mechanisms to simulate reliably the more extensive physical mechanisms in chemically reacting turbulent flows; (2) new diagnostic instrumentation-attention is focused on optimal measurements needed for current models, specifically laser Doppler velocimetry (LDV) and Raman, Rayleigh, and particle (Mie) scattering; (3) unconventional combustion systems-emulsified fuels are discussed as an example of the potential for ideas to challenge the state of the art. Research areas include emulsification to achieve a range of objectives (stability, particle size), emulsion diagnostics, and exploration of the altered combustion process. GRA

N76-11265# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
CHEMICAL FLAME INHIBITION USING MOLECULAR BEAM MASS SPECTROMETRY. REACTION RATES AND MECHANISMS IN A 0.3 PERCENT CF3Br INHIBITED METHANE FLAME Report of Investigations
Joan C. Biordi, Charles P. Lazzara, and John F. Papp May 1975 49 p refs
(PB-242622/9; BM-RI-8029) Avail: NTIS HC $4.00 CSCL 21B

Composition profiles for atomic, radical, and stable species, as well as temperature and area expansion ratio profiles, were determined for a nearly stoichiometric CH4-O2-Ar flame and one to which 0.3% CF3Br inhibitor had been added. Net reaction rate profiles were calculated for all the observed species. For the normal flame, these and the mole fraction profiles gave rate coefficient information about the elementary reactions in the methane flame. GRA

N76-11266# Sandia Labs., Albuquerque, N.Mex.
GAS DYNAMIC PROBLEMS IN ISOTOPE SEPARATION Final Report
K. J. Touryan, E. P. Muntz (Univ. of Southern Calif., Los Angeles), L. Talbot (Univ. of Calif., Berkeley), and E. VonHalle (Union Carbide Corp., Oak Ridge, Tenn.) Mar. 1975 83 p refs Workshop held in Albuquerque, N. Mex., 4-5 Dec. 1974
(Contract AT(29-1)-789; Grant NSF ENG-75-05424)
(PB-243215/1; SAND-75-0121) Avail: NTIS HC $5.00 CSCL 18B

A synopsis is given of the presentations and discussions held at a workshop on the gas dynamic problems inherent in aerodynamic isotope separation devices. Five principal aerodynamic devices are considered in some detail. These are: (1) the curved separation nozzle; (2) the opposing jet scheme; (3) the separation probe scheme; (4) the jet membrane device; and (5) the crossed-beam device. GRA

N76-11267# Boston Univ., Mass. Dept. of Chemistry.
VALENCE PHOTOISOMERIZATION OF 1-ETHOXYCARBONYL-1H-AZEPINE AND ITS THERMAL REVERSION, QUANTITATIVE ASPECTS Technical Report, 1 Jul. 1974 - 31 May 1975
Guilford Jones, II and Laura J. Turbini 15 Jun. 1975 29 p refs Submitted for publication
(Contract N00014-67-A-0280-0003; ARPA Order 2721)
(AD-A011908; TR-2) Avail: NTIS CSCL 07/5

Photolysis of 1-ethoxy carbonyl-1 H-azepine in solution at 325 - 385 nm gives a valence isomer with a chemical efficiency of 95% and a quantum efficiency of 0.013. The valence isomer reverts cleanly to azepine at 112 - 145C in an uncatalyzed reaction which is exothermic. The valence isomerization can be driven by sunlight and laser emission at 458 nm and cycled in sequential photochemical and thermal steps. The azepine does not luminesce but the energies of S(1) (reactive) and T(1) (unreactive) excited states can be estimated from sensitization and quenching experiments. GRA

N76-11268# Case Western Reserve Univ., Cleveland, Ohio. Electrochemistry Research Lab.
OXYGEN ELECTRODE KINETICS ON VARIOUS ELECTRODE SURFACES
Ernest Yeager 1 May 1975 35 p refs Presented at Fuel Cell Catalyst Workshop of the Elec. Power Res. Inst.
(Contract N00014-75-C-0953; NR Proj. 359-451)
(AD-A011905; TR-42) Avail: NTIS CSCL 07/4

The results of research on the kinetics of oxygen reduction are presented for various carbon and graphite surfaces and gold. The reduction on these surfaces proceeds through only the peroxide mechanism. This kinetic data provide a quantitative insight into the operation of fuel cell O2 cathodes involving these catalytic surfaces. Promising directions for improving catalytic activity and performance are suggested. GRA

N76-11269# Massachusetts Inst. of Tech., Cambridge. Fuels Research Lab.
MEASUREMENT OF FLAMMABILITY AND BURN POTENTIAL OF FABRICS Summary Report, 1 Dec. 1971 - 31 Jan. 1973
Arun K. Mehta and Franklin Wong 15 Feb. 1973 331 p refs Sponsored in part by NBS, Washington, D. C.
(Contract NSF GI-31881)

(PB-242582/5; NSF/RA/E-73-191) Avail: NTIS HC $10.00 CSCL 11E

Two types of inanimate materials having the average thermal properties of human skin were studied. The thermal properties of both types of skin simulants, which were checked by exposing them to known radiant fluxes and monitoring the temperature response, were found to agree closely with the design values. A set of twenty different fabrics, widely used in apparel, were tested. The depth of thermal damage was found to increase approximately linearly with increase in the total thermal dose to skin, for the exposure times and the magnitudes of the heat fluxes involved in these specific fabric burning experiments. This finding indicates the possibility of rating the burn damage potential of fabrics, crudely, by only two measurements, namely flame spread rate and total thermal damage to skin. Measurements of the heat transfer rates from the leading edge to the fuel were conducted with the flame spread burner. GRA

N76-11270# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

REACTION OF FLAME FRONT TO THE EFFECT OF SHOCK WAVE

V. R. Karpov 26 Nov. 1974 17 p Transl. into ENGLISH from the monograph "Gorenie i Vzryv" Moscow, 1972 p 382-385

(AD-A006009; FTD-MT-24-1928-74) Avail: NTIS CSCL 21/2

Shock tubes were used to obtain a sharp picture of the reaction of flame front to a shock wave. The parameters of incident and reflected waves were calculated from a pressure differential on the membrane. Author

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-11271# Gruppe fuer Ruestungsdienste, Thun (Switzerland). Munitionskontrolle und Materialpruefung

ELECTRON MICROSCOPIC STUDIES ON PRECIPITATING REACTIONS IN AN AlZnMgI [ELEKTRONENMIKROSKOPISCHE UNTERSUCHUNG UEBER DIE AUSSCHEIDUNGSVORGAENGE IN EINER Al-ZnMgII-LEGIERUNG]

A. Durtschi and P. Valsangiacomo 30 Jul. 1974 30 p refs In GERMAN

(CH-3602; Du/Wa-21.3/1720) Avail: NTIS HC $4.00

Microscopic evaluation of heat treatment effects at 450 C on the microstructure of AlZnMg alloys established elogation limits and precipitation reactions in relation to cooling temperatures and cooling duration. A stepped cooling process from 90 C and 145 C produced elogation limits of 380 N/sq mm and almost complete hardness. Transl. by G.G.

N76-11272*# Transemantics, Inc., Washington, D.C.

CATHODIC REDUCTION OF OXYGEN OF POROUS TITANIUM AND CHROMIUM CARBIDES AND NITRIDES

I. I. Vasilenko, N. N. Nechiporenko, and A. K. Gorbachev Washington NASA Oct. 1975 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Khim. Khim. Tekhnol. (Ivanovo), v. 18, no. 1, 1972 p 42-45

(Contract NASw-2792)

(NASA-TT-F-16617) Avail: NTIS HC $3.50 CSCL 11F

The study was made in order to investigate the cathodic reduction of oxygen on porous titanium and chromium nitrides and carbides in connection with the necessity of further development of electrochemical processes of oxygen and air depolarization in the electrolysis of aqueous acid-containing solutions. At the same time, methods of preparation of electrode materials, their catalytic activity in the decomposition of hydrogen peroxide (the intermediate product of oxygen reduction), and the corrosion resistance were examined. It was found that the rate of cathodic reduction of oxygen on porous electrodes made of titanium and chromium carbides and nitrides depends on the catalytic activity and physical properties of the electrode materials, and on the electrolyte composition. Author

N76-11273*# Mar-Test, Inc., Cincinnati, Ohio.

HIGH-TEMPERATURE, LOW-CYCLE FATIGUE OF COPPER-BASE ALLOYS FOR ROCKET NOZZLES. PART 1: DATA SUMMARY FOR MATERIALS TESTED IN PRIOR PROGRAMS Technical Report, Jul. - Oct. 1975

J. B. Conway, R. H. Stentz, and J. T. Berling Nov. 1975 310 p refs

(Contract NAS3-19720)

(NASA-CR-134908; MTI-003-3-1-Pt-1) Avail: NTIS HC $9.75 CSCL 11F

A more detailed analysis of the results obtained in 188 previously reported low-cycle fatigue tests of various candidate materials for regeneratively-cooled, reusable rocket nozzle liners was reported. Plots of load range versus cycles were reported for each test along with a stress-strain hysteresis loop near half-life. In addition, a summary table was provided to compare N5 (cycles to a five percent load range drop) and Nf (cycles to complete specimen separation) values for each test. Author

N76-11274*# Scientific Translation Service, Santa Barbara, Calif.

ADDITIVE STRENGTH CONTRIBUTIONS

V. Andreason Washington NASA Nov. 1975 109 p refs Transl. into ENGLISH of Rept. RISO-M-1714 Danish AEC (Risoe), Apr. 1974 99 p

(Contract NASw-2791)

(NASA-TT-F-16613; RISO-M-1714) Avail: NTIS HC $5.50 CSCL 11F

A literary review of theories and models proposed for dispersion hardening, solid solution hardening, grain boundary hardening, and work-hardening of dispersion hardening alloys is given. The movement of a dislocation line through an array of different kinds of obstacles was examined in order to investigate the interaction between different hardening mechanisms. Experimentally the plastic deformation at room temperature of Cu, Cu-Ag, Cu-Al2O3, and Cu-Ag-Al2O3 alloys was examined as a function of composition and volumn fraction. The alloys were in the form of polycrystals and single crystals were deformed in the (112)-direction. The solid solution hardening is shown to be additive to the other strengthening mechanisms. The workhardening from the dispersed particles was determined and found to be in agreement with the theories proposed by Ashby and Hart. Author

N76-11275*# Pratt and Whitney Aircraft, East Hartford, Conn.

CONTINUED DEVELOPMENT OF ABRADABLE GAS PATH SEALS Final Report, 25 Sep. 1974 - 29 Aug. 1975

L. T. Shiembob 1 Nov. 1975 100 p refs

(Contract NAS3-18565)

(NASA-CR-134879; PWA-5314) Avail: NTIS HC $4.75 CSCL 11F

Major program objectives were the continued development of NiCrAlY feltmetal and honeycomb systems for knife edge seal applications in the 1144 to 1366 K temperature range, and to initiate abradable seal material evaluation for blade tip seal applications in the 1366 to 1589 K temperature range. Larger fiber size, higher density feltmetal showed greatly improved erosion resistance with a slight reduction in abradability compared to the baseline feltmetal. Pack aluminide coating of the honeycomb extended the oxidation resistance and slightly improved the abradability of this material. Evaluation through selected abradability, erosion and oxidation testing, and pertinent metallography led to selection of a plasma sprayed yttria stabilized zirconia (ZrO2)/CoCrAlY layered system as the system with the most potential to meet the 1589 K requirement for blade tip seals. This system demonstrated structural integrity, erosion resistance, and some degree of abradability. Author

N76-11276*# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.

THERMAL DIFFUSE X-RAY SCATTERING IN SIMPLE METALS

David M. Straus and N. W. Ashcroft Nov. 1975 52 p refs

(Grant NGR-33-010-188)

(NASA-CR-145613; Rept-2559) Avail: NTIS HC $4.50 CSCL 11F

Calculations are reported for the ionic structure factor and X-ray scattering cross section of sodium (at T=0 K and 90 K) and lithium (both isotopes at T=0 K) within the harmonic

approximation. An evaluation of the appropriate displacement-displacement correlation function by the special point method circumvents the need for a multiphonon expansion. In the case of sodium, the structure in the one-phonon scattering was straightforwardly accounted for, and an approximate expansion was obtained for all multiphonon scattering. By treating core and conduction electrons on an equal footing, it is shown that information on the conduction electron system is present in the forward scattering component. In lithium the one-phonon cross section at small angles aids in the determination of the effective electron-ion interaction. Author

N76-11277*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MECHANICAL TEST IN-SITU FRACTURE DEVICE FOR AUGER ELECTRON SPECTROSCOPY

R. Dale Moorhead Sep. 1975 17 p refs

(NASA-TM-X-62486; A-6273) Avail: NTIS HC $3.50 CSCL 11F

An in-situ fracture device for Auger spectroscopy was described. The device is designed to handle small tensile specimens or small double cantilever beam specimens and is fully instrumented with load and displacement transducers so that quantitative stress-strain measurements can be made directly. Some initial test results for specimens made from 4130 and 1020 steel were presented. Author

N76-11278*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF LONG-TERM AGING ON DUCTILITY OF THE COLUMBIUM ALLOYS C-103, Cb-1Zr, AND Cb-752 AND THE MOLYBDENUM ALLOY Mo-TZM

Joseph R. Stephens Washington Oct. 1975 27 p refs

(NASA-TN-D-8095; E-8374) Avail: NTIS HC $3.75 CSCL 11F

A program was conducted to determine if aging embrittlement occurs in the columbium alloys C-103, CB-1Zr, and Cb-752 or in the molybdenum alloy Mo-TZM. Results showed that aging embrittlement does not occur in C-103, Cb-1Zr, or Mo-TZM during long-term (1000 hr) aging at temperatures in the range 700 to 1025 C. In contrast, aging embrittlement did occur in the Cb-752 alloy after similar aging at 900 C. A critical combination of the solute additions W and Zr in Cb-752 led to Zr segregation at grain boundaries during long-term aging. This segregation subsequently resulted in embrittlement as indicated by an increase in the ductile-brittle transition temperature from below -1960 C to about -150 C. Author

N76-11279*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CRITICAL ASPECT RATIO FOR TUNGSTEN FIBERS IN COPPER-NICKEL MATRIX COMPOSITES

Robert W. Jech Washington Oct. 1975 23 p refs

(NASA-TM-X-3311; E-8442) Avail: NTIS HC $3.50 CSCL 11F

Stress-rupture and tensile tests were conducted at 816 C (1500 F) to determine the effect of matrix composition on the minimum fiber length to diameter ratio (critical aspect ratio) below which fibers in a tungsten fiber/copper-nickel alloy matrix composite could not be stressed to their ultimate load carrying capability. This study was intended to simulate some of the conditions that might be encountered with materials combinations used in high-temperature composites. The critical aspect ratio for stress-rupture was found to be greater than for short-time tension, and it increased as the time to rupture increased. The increase was relatively slight, and calculated fiber lengths for long service appear to be well within practical size limits for effective reinforcement and ease of fabrication of potential gas turbine components. Author

N76-11280# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

EFFECT OF TEMPERATURE ON CREEP CRACK PROPAGATION IN AISI TYPE 316 STAINLESS STEEL

R. D. Nicholson Nov. 1974 17 p refs

(RD/B/N-3029) Avail: ERDA Depository Libraries HC $4.00

Creep crack growth rates were measured in double edge notched specimens of solution treated stainless steel at temperatures of 600, 700, 740, 800, and 850 C. The crack growth rates were determined. Apparent activation energies for creep and creep crack growth were measured in the temperature range 740 to 850 C, and over limited ranges of stress and temperature, comparable energy values were found. These results suggest that a creep mechanism involving dislocation climb could be rate controlling in the crack propagation process. The results are explained by considering the stress redistribution that takes place at the crack tip and the resulting strains in the specimen, indicating that creep crack growth is governed by ligament and ultimately by crack tip displacements. Author

N76-11281# George Washington Univ., Washington, D.C. Inst. for the Study of Fatigue Fracture and Structural Reliability.

THE INTERACTION OF CYCLIC SHEAR AND AXIAL TENSION IN CYCLIC CREEP OF TITANIUM

Pankaj K. Basu and Charles K. Gilmore May 1975 20 p refs

(Contract N00014-75-C-0276)

(AD-A011841; TR-22) Avail: NTIS CSCL 11/6

The cyclic creep of commercially pure titanium was determined as a function of cyclic torsional strain amplitude and constant axial stress. For a fixed axial stress, the axial strain is proportional to the square of the cyclic torsional strain. Previous experiments have indicated a linear proportionality, but these more expensive experiments show conclusively that there is a quadratic proportionality. For a fixed peak cyclic torsional strain amplitude the axial strain is linearly proportional to the axial stress. In these tests no point of instability in the cyclic strain is observed as either axial stress or cyclic torsional strain amplitude is increased. This indicates that no truly elastic response is observed in this alloy under these cyclic test conditions. GRA

N76-11282# George Washington Univ., Washington, D.C. Inst. for the Study of Fatigue Fracture and Structural Reliability.

STATIC AND CYCLIC CREEP PROPERTIES OF FATIGUE FRACTURE AND STRUCTURAL RELIABILITY

Charles M. Gilmore and M. Ashraf Imam Apr. 1975 27 p refs

(Contract N00014-75-C-0276; N00019-75-C-0093)

(AD-A011842; TR-21) Avail: NTIS CSCL 11/6

The room temperature static and cyclic creep properties were determined for Ti-6Al-4V in three anneal conditions (alpha beta) anneal, beta anneal and recrystallized anneal). The static and cyclic creep strains were inversely related to microstructure. The beta annealed alloy has the smallest static creep strain and the largest cyclic creep strain; the recrystallized anneal alloy has the largest static creep and the smallest :cyclic creep. This behaviour indicates that static creep and cyclic creep are a result of different mechanisms. It is proposed that the static creep is a result of dislocation motion within the grains, and the dislocation motion is impeded by phase and grain boundaries to limit static creep strains. The cyclic creep deformation appears to be localized at the grain and phase boundaires. It is proposed that in cyclic creep the dislocations migrate to the strong boundaries and then move back and forth under the cyclic loading producing vacancies at jog sites during each cycle. The vacancies condense into microcracks that are observed after etching. GRA

N76-11283# Illinois Univ., Urbana. Dept. of Physics.

HYDROGEN IN METALS AND ON METAL SURFACES Final Report, 1974-1975

C. P. Flynn May 1975 9 p

(Contract N00014-67-A-0305-0027)

(AD-A011914) Avail: NTIS CSCL 14/2

The report briefly describes a magnetooptic apparatus, and an apparatus for study of optical absorbate excitations. GRA

N76-11284# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.

THE EFFECT OF QUENCH RATE ON THE PROPERTIES OF FERROUS MARTENSITE

S. J. Donachie and G. S. Ansell Mar. 1975 53 p refs Submitted for publication

(Contract N00014-67-A-0117-0011; NR Proj. 031-689)

(AD-A011909; TR-5) Avail: NTIS CSCL 11/6

The effect of high quench rate on the M sub s temperature, percent transformed, martensite morphology and austenite hardness has been studied for several Fe-Ni-C steels. For these

steels the quench rate was varied only in the austenite region. The M sub s temperature was found to increase with increased quench rate for both high and low carbon steels while the percent transformation increased or decreased depending upon the morphology of the steel. Parallel aligned plate structures were observed which resemble a twinned lath morphology. It was demonstrated that the actual difference between this morphology and a true lath structure. The morphology changes were compared to the measured changes in martensite properties in order to identify the mechanism of the morphology shift. It was concluded that for these alloys the morphology was controlled by the austenite shear mode. GRA

N76-11285# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
MICROSTRUCTURAL EVALUATION AND CONTROL Final Report, Sep. 1969 - Jun. 1975
John J. Petrovic, Harry A. Lipsitt, and Loren A. Jacobson Apr. 1975 9 p refs
(AF Proj. 7021)
(AD-A011981; ARL-75-0109) Avail: NTIS CSCL 11/6

The microstructures of metallic systems were investigated. The three distinct areas of effort were: (1) effects of thermomechanical processing on properties of aluminum alloy; (2) precipitation in aluminum 4% chromium and aluminum 0.6% zirconium alloys; and, (3) 2024 deformation and annealing of silver-nickel two-phase alloys. The major results are summarized. GRA

N76-11245 Advisory Group for Aerospace Research and Development, Paris (France).
BASIC DATA
In its High Temperature Corrosion of Aerospace Alloys Aug. 1975 p 1-26 refs (For availability see N76-11244 02-23)

N76-11246 Advisory Group for Aerospace Research and Development, Paris (France).
PREDOMINANCE DIAGRAMS
In its High Temperature Corrosion of Aerospace Alloys Aug. 1975 p 27-36 refs (For availability see N76-11244 02-23)

N76-11248 Advisory Group for Aerospace Research and Development, Paris (France).
VAPOR PRESSURE AND CONDENSATION OF SODIUM SULPHATE
In its High Temperature Corrosion of Aerospace Alloys refs (For availability see N76-11244 02-23)

N76-11249 Advisory Group for Aerospace Research and Development, Paris (France).
OXIDATION AND HOT CORROSION OF COMMERCIAL SUPERALLOYS
In its High Temperature Corrosion of Aerospace Alloys Aug. 1975 p 117-462 refs (For availability see N76-11244 02-23)

N76-11250 Advisory Group for Aerospace Research and Development, Paris (France).
THE REFRACTORY METALS
In its High Temperature Corrosion of Aerospace Alloys Aug. 1975 p 463-602 refs (For availability see N76-11244 02-23)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-11286*# United Technologies Research Center, East Hartford, Conn.
GRAPHITE FIBER REINFORCED THERMOPLASTIC RESINS
R. C. Novak 17 Jul. 1975 150 p refs
(Contract NAS3-17833)
(NASA-CR-134881; R75-911992-12) Avail: NTIS HC $6.00 CSCL 11I

Mechanical properties of neat resin samples and graphite fiber reinforced samples of thermoplastic resins were characterized with particular emphasis directed to the effects of environmental exposure (humidity, temperature and ultraviolet radiation). Tensile, flexural, interlaminar shear, creep and impact strengths were measured for polysulfone, polyarylsulfone and a state-of-the-art epoxy resin samples. In general, the thermoplastic resins exhibited environmental degradation resistance equal to or superior to the reference epoxy resin. Demonstration of the utility and quality of a graphite/thermoplastic resin system was accomplished by successfully thermoforming a simulated compressor blade and a fan exit guide vane. Author

N76-11287*# Lehigh Univ., Bethlehem, Pa.
THE EFFECT OF ADHESIVE LAYER ELASTICITY ON THE FRACTURE MECHANICS OF A BLISTER TEST SPECIMEN
D. P. Updike Sep. 1975 30 p refs
(Grant NGR-39-007-011)
(NASA-CR-145740) Avail: NTIS HC $4.00 CSCL 11A

An analytical model of a blister type specimen for evaluating adhesive bond strength was developed. Plate theory with shear deformation was used to model the deformation of the plate, and elastic deformation of the adhesive layer is taken into account. It is shown that the inclusion of the elastic deformation of the adhesive layer can have a significant influence in the energy balance calculations of fracture mechanics. Author

N76-11288*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SURFACE RECESSION CHARACTERISTICS OF A CRYOGENIC INSULATION SUBJECTED TO ARC-TUNNEL HEATING
Claud M. Pittman and Ronald D. Brown Washington Nov. 1975 29 p refs
(NASA-TM-X-3291; L-10371) Avail: NTIS HC $4.00 CSCL 11D

Specimens of a cryogenic insulation, proposed for use on the space shuttle external tank, were tested in an arc tunnel over a range of heating rates, pressures, and enthalpies corresponding to the shuttle ascent environment. A regression analysis was used to correlate the test data. Correlation equations involving surface recession rate as a function of heating rate, pressure, and enthalpy were developed. These equations can be used to make total surface recession predictions for shuttle ascent flight environments. Author

N76-11289*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PMR POLYIMIDES WITH IMPROVED HIGH TEMPERATURE PERFORMANCE
Raymond D. Vannucci and William B. Alston [1975] 20 p refs Proposed for presentation at 31st Ann Reinforced Plastics Composites Conf., Washington, D. C., 3-6 Feb. 1976; Sponsored by Soc. of Plastics Ind.
(NASA-TM-X-71816; E-8513) Avail: NTIS HC $3.50 CSCL 07C

Studies were performed to investigate the effect of substituting a hexafluoro isopropyl idene connecting group for a carbonyl group of a PMR polyimide monomeric reactant on the thermomechanical properties processability of graphite fiber reinforced PMR polyimide composites. Composites were fabricated utilizing PMR methodology. Monomeric reactant solutions of various stoichiometric ratios were used to impregnate Hercules HTS graphite fiber. The processing characteristics and elevated temperature (600 F) mechanical properties of the composites are described. Author

N76-11290# Centre National d'Etudes Spatiales, Toulouse (France).
RESULTS OF VACUUM OUTGASSING OF POLYMERS: WEIGHT LOSSES, CONDENSATES AT 25 C WITH IR AND UV SPECTRA [RESULTATS DE DEGAZAGE SOUS VIDE DE POLYMERES: PERTES DE POIDS - CONDENSATS A 25 C AVEC SPECTRES INFRAROUGES ET ULTRAVIOLETS]
Jacques Guillin Jul. 1975 97 p refs In FRENCH; ENGLISH summary
(CNES-NT-20) Avail: NTIS HC $5.00

The weight losses of polymer heated to 125 C for 24 hours

in a vacuum are tabulated. The outgassed condensed vapor weight at 25 C is also given. A total of 61 IR and UV spectra of volatile condensable materials are given. The outgassing method and test apparatus are described. ESA

N76-11291# Royal Aircraft Establishment, Farnborough (England).
SOME OBSERVATIONS ON THE BEHAVIOUR OF SUPERIMPOSED AND LAP SEWN JOINTS
M. Webb Feb. 1975 47 p refs
(RAE-TR-74183; BR46833) Avail: NTIS HC $4.00

Polyester sewing threads with different breaking strengths were used in the construction of sewn joints in four types of webbing. The joints were made having either a 3-point double W stitching pattern of various lengths or a number of rows of transverse stitching. The breaking strength of the stitched joints attained a limiting value. Various methods of seam strength prediction were investigated. Author (ESA)

N76-11292# Ministry of Defence, London (England).
THE EVALUATION OF VHR 2A AND VHR 3A GLASSES (GLAVERBEL-MECANIVER S.A.) FOR AEROSPACE APPLICATIONS
N. S. Corney Mar. 1975 32 p refs
(BR44083; DR-Mat-198) Avail: NTIS HC $4.00

The mechanical properties of two glasses for aircraft transparencies were evaluated using beam specimens of 2mm thickness. The products are shown to be of reproducible quality with modulus of rupture 247 MPa (standard deviation 11 MPa) for VHR 2A and 233 MPa (standard deviation 7 MPa) for VHR 3A. The effects of a standard sand abrasion at two levels of severity were investigated. Some thermal ageing experiments were carried out on both glasses in the unloaded condition. Sustained loading experiments for 3000h at 60% of the modulus of rupture in the as-received (or appropriately abraded condition) were carried out and indicated no significant effect of sustained loading on modulus of rupture. Likewise cyclic loading experiments on the as-received glasses for 2000h at a cycle of 3h on load (at a value of 30% of the initial modulus of rupture), 0.5h off load, caused no degradation of the modulus of rupture. Climatic weathering tests on these glasses are in progress and the results to date show no deterioration of the modulus of rupture after 1 year exposure in the unloaded condition. It is shown that both VHR2A and VHR3A glasses of 2mm thickness have properties entirely suitable for certain aircraft applications e.g. as facing glasses for structural plies of plastic materials or as laminating piles for low speed aircraft. Because of the improved resistance of the VHR3A glass at the more severe level of abrasion this glass might be preferred in particular applications.
Author (ESA)

N76-11293# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
MODEL INVESTIGATIONS OF THE STRENGTH OF INORGANIC NONMETALLIC MATERIALS WITH INHOMOGENEITIES UNDER DYNAMIC STRAIN [MODELLUNTERSUCHUNGEN ZUM FESTIGKEITSVERHALTEN VON ANORGANISCHEN, NICHTMETALLISCHEN WERKSTOFFEN MIT INHOMOGENITAETEN BEI DYNAMISCHER BEANSPRUCHUNG]
L. Hodulak Oct. 1974 56 p refs In GERMAN
(IFKM-WB-5/74) Avail: NTIS HC $4.50

The effect of dynamic loads on the stress concentration in inhomogeneous materials was investigated with optical methods on models consisting of a plate with circular holes and a plate with inclusions. The results for plates with holes show that the differences in stress distribution at the edges of the holes for dynamic loads and static loads are immaterial. For plates with inclusions, dynamic effects are more pronounced, but not serious. This leads to the general conclusion that the interaction between two circular inhomogeneities, leading to local stress variations in the static case, produces further stress variations for dynamic loads, the magnitudes of which do not contribute to an additional danger of fracture. ESA

N76-11294# Naval Research Lab., Washington, D.C.
THE RELATION OF THE SURFACE PROPERTIES OF THE TEFLONS TO FRICTIONAL ELECTRIFICATION BY POLYSTYRENE Final Report
James B. Romans and William A. Zisman 6 Jun. 1975 31 p refs
(RR0220844)
(AD-A011813; NRL-7892) Avail: NTIS CSCL 20/12

The friction and frictional electrification properties of Teflon TFE (polytetrafluoroethylene), Teflon PFA (tetrafluoroethylene-perfluoro-(alkyl vinyl ether) copolymer) and Teflon FEP (tetrafluoroethylene-hexafluoropropylene copolymer) have been studied by rubbing them against polystyrene. Potentials generated on the fluorocarbon polymers were measured by the classical Faraday ice-pail method. The relationship of surface energy and chemical constitution of the fluorocarbon surfaces to kinetic coefficient of friction and frictional electrification properties was investigated by using the contact-angle technique. The effects of annealing were also investigated. Results are discussed, and mechanistic explanations are proposed. GRA

N76-11295# Firestone Tire and Rubber Co., Akron, Ohio. Central Research Labs.
DEVELOPMENT AND EVALUATION OF PHOSPHONITRILIC FLUOROELASTOMER O-RINGS Final Report, 13 Feb. 1974 - 12 Feb. 1975
Gary S. Kyker Apr. 1975 179 p refs
(Contract DAAG46-74-C-0066)
(AD-A012266; AMMRC-CTR-75-6) Avail: NTIS CSCL 11/1

The purpose of this investigation was to develop and evaluate phosphonitrilic flouroelastomer compounds for O-ring hydraulic seal applications. Formulations were sought which would be serviceable in hydraulic fluids over the temperature range of -80F to 400F. The polymer used in this investigation was a phosphonitrilic fluoroelastomer prepared in the Central Research Laboratories of The Firestone Tire and Rubber Company and having the formula: (P(OCH2CF3)(OCH2C4F8H)N)n. The effects of reinforcing agents, vulcanization agents and stabilizers on compound properties were investigated. Efforts were made to optimize curing times and temperatures; stress-strain properties; hardness; compression set; tear and abrasion resistance; fluid, water, steam and acid resistance, and low temperature flexibility. In addition, the Seal Group of Parker Hannifin fabricated O-ring seals from selected stocks and conducted dynamic extrusion and chew tests on the seals. In related studies experiments were conducted on the coating of stainless steel cable with phosphonitrilic fluoroelastomer compounds. GRA

N76-11296# California Univ., Berkeley. Dept. of Chemical Engineering.
VISCOELASTIC PROPERTIES OF HOMOGENEOUS TRIBLOCK COPOLYMERS OF STYRENE/ALPHA-METHYL STYRENE AND THEIR POLYBLENDS WITH HOMOPOLYMERS
David R. Hansen and Mitchel Shen 1 Jul. 1975 38 p refs Submitted for publication
(Contract N00014-75-C-0955)
(AD-A011910; TR-2) Avail: NTIS CSCL 20/12

Seven triblock copolymers of styrene/alpha-methyl styrene were prepared via anionic polymerization. Two types of block structures, ASA and SAS, were made. By the use of Time Temperature Superposition Principle, stress relaxation isotherms of these block copolymers were readily shifted into smooth viscoelastic master curves. The shift factor data of all the block copolymers follow the classical WLF equation. Loss tangent data obtained by dynamic mechanical measurements show only one glass transition in each of these block copolymers, thus indicating the homogeneous nature of these materials. From the master curves, maximum relaxation times were determined by Procedure X method of Tobolsky and Murakami. These maximum relaxation times were found to vary as a function of copolymer composition and block structure. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-11297*# National Bureau of Standards, Boulder, Colo.
HYDROGEN TECHNOLOGY SURVEY: THERMOPHYSICAL PROPERTIES
Robert D. McCarty Washington NASA 1975 535 p refs Sponsored by NASA
(NASA-SP-3089) Avail: NTIS HC $13.00 CSCL 21D

The thermodynamic functions, transport properties, and physical properties of both liquid and gaseous hydrogen are presented. The low temperature regime is emphasized. The tabulation of the properties of normal hydrogen in both Si and engineering units is given along with the tabulation of para-hydrogen. Author

N76-11298# Rocket Propulsion Establishment, Westcott (England).
THE HETEROGENEOUS DECOMPOSITION OF HYDRAZINE. PART 6: KINETICS OF THE DECOMPOSITION ON SUPPORTED PALLADIUM AND PLATINUM CATALYSTS
C. F. Sayer Nov. 1974 28 p refs
(RPE-TR-31-Pt-6; BR47538) Avail: NTIS HC $4.00

The decomposition of hydrazine on either a palladium or a platinum catalyst may be represented by the reaction 2N2H4 yields N2 + H2 + 2NH3. The observed one half order kinetics, changing to zero order with platinum, may be explained by deriving rate equations from the Langmuir adsorption isotherm and assuming that the initial, slow, step is the dissociative chemisorption of hydrazine in the form of NH2 radicals. In accordance with the dual plane theory of Cosser and Tompkins, it is suggested that the adsorption process and subsequent reaction occur only on the active sites of these metals. Because these catalysts are much less active than a supported iridium catalyst, neither is considered as an alternative for use in catalytic hydrazine thrusters. Author (ESA)

N76-11299# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
FUEL-AIR-EXPLOSIVES. EXPLOSIONS OF UNCONFINED VAPOUR CLOUDS (LITERATURE SURVEY)
K. Coevert, M. T. Groothuizen, H. J. Pasman, and R. W. Trense 24 Jan. 1975 34 p refs
(Contract A73/KL/083-G-3372-II(9630))
(TL-1975-2; TDCK-65977) Avail: NTIS HC $4.00

A tentative evaluation of the problem of explosions of unconfined vapor clouds was made. The basic concepts of deflagrative and detonative combustion are reviewed and current research studies are discussed, with particular regard to the blast wave generation by unconfined vapor cloud explosions. ESA

N76-11300# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
INVESTIGATION INTO THE COMPATIBILITY OF EXPLOSIVES IN MUTUAL CONTACT AND/OR IN CONTACT WITH NON-EXPLOSIVES. PART 2: COMPATIBILITY OF HIGH EXPLOSIVES WITH POLYMERS, STATE-OF-AFFAIRS AS PER JANUARY 1975
E. Mugge 7 Feb. 1975 37 p ref
(Contract A70/KL/057-A-3068(9100-II))
(TL-1975-7; TDCK-66365) Avail: NTIS HC $4.00

Short duration test methods for forecasting the compatibility of high explosives and polymers during prolonged storage periods were studied. High explosives and polymers in close contact were aged at elevated temperatures, namely for 40 h at 100 C (quick accelerated aging) and for 3, 6, and 12 months at 60 C (long term accelerated aging). Before and after the aging period the chemical and physical properties of the explosives and the tensile impact energy of the polymers were estimated. Vacuum stability tests and measurements of heat generation to evaluate the reactivity of the explosive-polymer systems were performed using three methods. The vacuum stability test seems to be the most suitable for a quick evaluation. Thermo-analytical measurements can give additional information. In all cases where the mechanical properties of the polymers are essential, measuring of the tensile impact energy of the polymer before and after storage in contact with the high explosive at 60 C for at least 3 months is recommended. Author (ESA)

N76-11301# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
INVESTIGATION INTO THE RELIABILITY OF SOLID ROCKET PROPELLANTS AND SOLID PROPELLANT ROCKET MOTORS. PART 9: ULTRASONIC INVESTIGATION OF MECHANICAL PROPERTIES OF DOUBLE BASE ROCKET PROPELLANTS
J. A. VanDerSchroeff, J. H. Gouda, and W. F. J. VanAltena 7 Apr. 1975 47 p refs
(Contract A64/KL/097-R-3007(8318-IX))
(TL-1975-8; TDCK-66166) Avail: NTIS HC $4.00

For a series of double base rocket propellants and for polymethylmethacrylate the longitudinal and transverse sound wave velocities were measured at a frequency of 0.351 MHz in the temperature range of -40 to +60 C. The relations between these acoustic properties and mechanical properties were derived and the principal independent elastic constants calculated. (ESA)

N76-11302# European Space Agency, Paris (France).
DEVELOPMENT AND APPLICATION OF PLASMA SOURCES FOR PLASMA CHEMICAL REACTIONS
Rainer Koehne and Friedrich Lindner Jun. 1975 44 p refs Transl. into ENGLISH of "Entwicklung u. Einsatz von Plasmaquellen fuer Plasmachemische Reaktionen", DFVLR, Stuttgart Report DLR-FB-75-27, 13 Feb. 1975 Original German report available from DFVLR, Porz, West Ger. 17.80 DM
(ESA-TT-168; DLR-FB-75-27) Avail: NTIS HC $4.00

Hydrazine is synthesized by addition of the short-lived radical NH to NH3. Production of this radical was attempted by combining the two streams from a hydrogen and nitrogen hollow cathode plasma source. NH was produced only in traces. An improved reactor for NH production was developed. An attempt was made to produce hydrazine in an argon burner by mixing N2 and NH3. The thermal load of the reactants was reduced by various arrangements. Author (ESA)

N76-11303# European Space Agency, Paris (France).
PREPARATION, CONVEYANCE AND COMBUSTION OF STABILIZED LIQUID OZONE
Rainer Boehm Jul. 1975 32 p refs Transl. into ENGLISH of "Herstellung, Foerderung u. Verbrennung von stabilisiertem fluessigem Ozon', DFVLR, Lampoldshausen, West Ger. Report DLR-Mitt-74-35, 23 Sep. 1974 Original German report available from DFVLR, Porz, West Ger. 11.50 DM
(ESA-TT-178; DLR-Mitt-74-35) Avail: NTIS HC $4.00

The combustion of stabilized, liquid ozone (LO3) with gaseous hydrogen was investigated in a special test combustion chamber. Stabilization was achieved with liquid oxygen difluoride (LOF2). A total of ten tests were completed, with ozone concentrations (by weight) set at either 10% or 40%. The preliminary research on coverging LO3-LOF2 mixtures through nozzles was successful. Two violent explosions occured during the experiments, one of which greatly damaged the test equipment. Author (ESA)

N76-11304# Aerojet Solid Propulsion Co., Sacramento, Calif.
DEVELOPMENT OF A SOLID ROCKET PROPELLANT NONLINEAR CONSTITUTIVE THEORY Final Report, May 1973 - Jul. 1974
Richard A. Farris, Leonard R. Herrmann, James R. Hutchinson, and Richard A. Schapery May 1975 404 p refs
(Contract F04611-73-C-0060; AF Proj. 3059)
(AD-A012213; ASPC-1074-26F; AFRPL-TR-75-20) Avail: NTIS CSCL 21/9

The objective of this program was to develop and demonstrate the accuracy of totally computerized response and failure characterizations and finite element stress and deformation analyses of propellant systems. These analyses were to be based on the nonlinear viscoelastic constitutive theory developed on earlier Air Force and Navy contracts. To meet these objectives, the work to be accomplished was divided into four distinct tasks.

Tasks I and III were development tasks wherein the computerized characterization and finite element programs were defined, coded and assembled. Tasks II and IV were demonstration tasks wherein the developments of Tasks I and III were evaluated in realistic situations. The technical discussion of this report provides a detailed description of the work performed to meet the objectives of this program. Also included under separate headings are the descriptions of each computer code, its function, and sample problems. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-11305*# Joint Publications Research Service, Arlington, Va.

APPLICATION OF CRYOGENIC TEMPERATURES

F. G. Patrunov Washington NASA Oct. 1975 49 p refs Transl. into ENGLISH from Novoye v Zhizni, Nauke, Tekhnike. Seriya Tekhnika (Moscow), no. 8, 1975 p 1-62 Sponsored by NASA

(NASA-TT-F-16562) Avail: NTIS HC $4.00 CSCL 20L

Various applications of cryogenic temperatures are discussed. Machines which use the phenomena of superconductivity are described, including a.c. collectors, transformers, generators and magnetohydrodynamic generators. The possibility of designing superconducting electric transmission lines and prospects for the use of low temperatures in ship building, motor vehicle building, electronic engineering, space exploration, biology and medicine are considered. Author

N76-11306# Advisory Group for Aerospace Research and Development, Paris (France).

LASER HAZARDS AND SAFETY IN THE MILITARY ENVIRONMENT

Aug. 1975 105 p refs Conf. held at Germany, 22-23 Sep. 1975, The Netherlands, 25-26 Sep. 1975, and Norway, 1-2 Oct. 1975; sponsored by the Aerospace Medical Panel and the Consultant and Exchange Panel of AGARD

(AGARD-LS-79) Avail: NTIS HC $5.50

A review of the theory, principles, and applications of laser systems was presented, with special emphasis on associated possible accidental injuries, safety precautions and codes, protective devices. For individual titles, see N76-11307 through N76-11316.

N76-11307 Western Ontario Univ., London. Dept. of Physics.

PROPERTIES OF ELECTROMAGNETIC RADIATION c36

J. Wm. McGowan *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 9 p refs (For availability see N76-11306 02-31)

The basic principles dealing with electromagnetic radiation were discussed, particularly as they relate to the development of the Laser and insofar as life processes are affected by light. It was pointed out that, although the electromagnetic spectrum extends over more than thirty orders of magnitude, that portion of it now dominated by the Laser only includes four. It is through this range that all life processes are affected by light and, in particular, the eye can easily be damaged by it. Author

N76-11308 Western Ontario Univ., London. Dept. of Physics.

LASERS c36

J. Wm. McGowan *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 12 p refs (For availability see N76-11306 02-31)

Principles and properties of the laser were discussed in some detail together with a description of the various types of lasers and their applications. Author

N76-11309 Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md. Laser Microwave Div.

INSTRUMENTATION AND MEASUREMENT OF LASER RADIATION c36

David H. Sliney *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 9 p refs (For availability see N76-11306 02-31)

New laser instruments and measurement techniques evolved during the past decade were reviewed. The measurements of primary interest in the evaluation of laser hazards are: output energy or power, pulse duration, beam profile and divergence, and pulse repetition frequency (PRF). The most useful types of detectors and beam profile methods were discussed. Short-cut check tests were also given. Author

N76-11310 Letterman Army Inst. of Research, San Francisco, Calif. Non-Ionizing Radiation Div.

OCULAR EFFECTS OF LASER RADIATION: CORNEA AND ANTERIOR CHAMBER c52

Edwin S. Beatrice and Bruce E. Stuck *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 5 p refs (For availability see N76-11306 02-31)

The effects of infrared laser radiation on the cornea and skin of humans were considered. Three areas were discussed: normal anatomy and physiology of both tissues, summary of those laser systems which may interact with these tissues, and effects of these systems on tissues. It is pointed out that threshold damage to the eye from CO2 laser radiation is confined to the more superficial areas of the cornea. At above threshold levels, damage is observed to the entire thickness, and some changes in the anterior chamber are observed. Y.J.A.

N76-11311 Letterman Army Inst. of Research, San Francisco, Calif. Non-Iodizing Radiation Div.

OCULAR EFFECTS OF RADIATION: RETINA c52

Edwin S. Beatrice *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 4 p refs (For availability see N76-11306 02-31)

A discussion of threshold levels associated with injuries to the primate retina from exposure to visible and near infrared laser radiation was given. It is explained that, while the retina is subdivided into ten identifiable layers, the absorption site of the visible and near infrared laser sources is limited to the melanin granules of the retinal pigment epithelium. The mechanism of injury at the above threshold exposed site is thermal. The endpoint for the determination of threshold levels can be subdivided into three areas: grossly observable retinal opacity level, light microscopic cellular alteration at the distal photoreceptor and pigment epithelial level, and subcellular change at the magnification power of the electron microscopic level. Y.J.A.

N76-11312 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

DETERMINATION OF SAFE EXPOSURE LEVELS: ENERGY CORRELATES OF OCULAR DAMAGE c52

R. G. Borland *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 6 p refs (For availability see N76-11306 02-31)

Three techniques were used to define practical but safe criteria for use with laser systems. These are: inspection of the eye by optical means (ophthalmoscopy), fluorescein angiography, and microscopy (light and electron). The detection of damage is a form of quantal response and the determination of the threshold level is normally based on the energy or power which will result in a given probability of damage being detected. The energy correlates of damage depend on wavelength, pulse width or exposure time, repetition rate, tissue type and pigmentation, and ocular quality. This complex relationship necessarily limits experimental research to laser systems of special interest and so the interpolation of data to formulate overall safe exposure levels is necessary. Author

N76-11313 Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md. Laser-Microwave Div.

DERIVATION OF SAFETY CODES. 1: USA EXPERIENCE

David H. Sliney *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 13 p refs (For availability see N76-11306 02-31)

A review of the problems encountered in setting safety standards and the complementary laser system classification and field safety controls since 1965 was presented. Originally, only two or three limits were provided. However, since 1972, a sliding

scale of limits varying with exposure duration, wavelength, and PRF have been in use, are now standardized throughout the USA, and are described in the paper. Author

N76-11314 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
DERIVATION OF SAFETY CODES. 2: UK EXPERIENCE
R. G. Borland *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 6 p refs (For availability see N76-11306 02-31)

A review of laser safety codes in use in the United Kingdom since 1965 was presented. The initial codes were based on limited experimental data and so tended to be over-cautious. More recent studies have been related to the practical situation of ocular irradiation by parallel beams and have suggested that the retinal radiant exposure for damage increases with decreasing image size; it followed that a considerable relaxation of the recommendations published in 1972 was possible. The British Standards Institute (BSI) has since then recommended adoption of the American Conference of Governmental Industrial Hygienists (ACGIH) exposure levels. Author

N76-11315 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
OPTHALMOLOGICAL EXAMINATION OF LASER WORKERS AND INVESTIGATION OF LASER ACCIDENTS **c52**
D. H. Brennan *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 11 p ref (For availability see N76-11306 02-31)

Those aspects of ocular structure and function which are relevant to laser induced damage in man were discussed, including the transmission and absorption characteristics of ocular tissues and the natural protective mechanisms of the eye. A scheme for the ocular surveillance of laser workers was presented with an evaluation of the role of the field and other specialized examinations. The procedure to be followed in the event of a laser accident was discussed. It is recommended that this involves a biophysical assessment of the accident with particular reference to energy or power densities which may have been incident on the cornea, as well as a detailed ocular examination. This may include fluorescein angiography, which has been found to be a more sensitive technique for detection of damage than ophthalmoscopy in monkeys. Author

N76-11316 Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md. Laser Microwave Div.
LASER PROTECTIVE DEVICES **c54**
David H. Sliney *In* AGARD Laser Hazards and Safety in the Mil. Environ. 1975 11 p refs (For availability see N76-11306 02-31)

The ideal characteristics of laser eye protective devices were presented and the present filter materials and goggle designs were compared with the ideal. Although the skin requires protection from lasers emitting in the ultraviolet and far-infrared regions at comparable exposure levels that may cause eye injuries, protection of the eye remains paramount. Author

N76-11317# Mar, Inc., Rockville, Md.
FEASIBILITY STUDY OF HELICOPTER-TOWED AIR CUSHION LOGISTIC VEHICLES Final Report, 31 Mar. - 30 Jun. 1975
V. F. Neradka, J. C. Stevens, and R. L. Levin Jun. 1975 67 p refs
(Contract N00014-73-C-0178)
(AD-A011803; TR-148) Avail: NTIS CSCL 13/10

A feasibility study of a helicopter-towed air cushion logistic vehicle (ACLV) was performed. The scope of the study encompassed movement of loaded LASH system lighters on unmanned air-cushion platforms from an off-shore ship onto a sand beach in support of amphibious assault operations. Motive power is to be provided by towing with RH-53 helicopter. Color illustrations reproduced in black and white. GRA

N76-11318# Battelle Columbus Labs., Ohio.
RECLAMATION OF METAL VALUES FROM METAL-FINISHING WASTE TREATMENT SLUDGES Final Report
Arch B. Tripler, Jr., R. H. Cherry, Jr., and G. Ray Smithson, Jr. Apr. 1975 97 p refs Sponsored by EPA, Cincinnati, Ohio
(PB-242018/0; EPA-670/2-75-018) Avail: NTIS HC $5.00 CSCL 13B

The efforts of this program have included the determination of the worth of recovering metal values from metal-finishers' wastewater treatment sludges, the definition and research of processes for such recovery, and the selection, design, and costing of a recommended process. The study included a survey of the literature to determine the state-of-the-art regarding the generation, disposal, and recovery treatment practices relevant to metal-finishers' sludges, and to identify metal recovery processes possibly applicable to those sludges. This information was supplemented with a survey by questionnaire to determine the current status of relevant practices and conditions. GRA

N76-11319# Washington Univ., Seattle. Dept. of Mechanical Engineering.
MODELING OF SHIPBOARD FIRE SUPPRESSION Annual Report, 1 Jul. 1973 - 30 Jun. 1974
R. C. Corlett 13 Jun. 1975 28 p refs
(Contract N00014-67-A-0103)
(AD-A011373) Avail: NTIS CSCL 13/12

Further smoke production measurements are reported. Smoke production per unit mass is deduced on the basis of exhaust stream CO2 concentration data. A matrix of fire suppression tests with water spray and CO2 has been carried out in the 6x6x6 ft fire enclosure and in a 2x2x2 ft scale model enclosure. A simple correlation indicative of a concise scaling rule was not expected and, in fact, did not result. But the data do constitute a basis for evolution of an empirically adjusted rational model whose intended application is extension of small scale or otherwise inexpensive test data to larger scale or relatively expensive situations. GRA

N76-11703 Washington Univ., Seattle. Dept. of Rehabilitation Medicine.
ON EMP SAFETY HAZARDS
Arthur W. Guy *In* AGARD Radiation Hazards Aug. 1975 7 p refs (For availability see N76-11693 02-51)

N76-11704 Rochester Univ., N.Y. School of Medicine and Dentistry.
PROTECTION GUIDES AND STANDARDS FOR MICROWAVE EXPOSURE
Sol M. Michaelson *In* AGARD Radiation Hazards Aug. 1975 6 p refs (For availability see N76-11693 02-51)

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N76-11320 British Broadcasting Corp., Kingswood (England). Engineering Div.
RADIO MICROPHONES: A QUADRUPLE-DIVERSITY RECEPTION SYSTEM
R. D. C. Thoday Oct. 1975 19 p refs
(BBC-RD-1975/30) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England CSCL 17B

An experimental radio microphone receiver diversity unit intended for use in television studios is described. The unit utilizes post detection combination and achieves near optimum signal to noise performance by way of a digitally processed control signal. Author

N76-11321*# Ohio State Univ., Columbus. ElectroScience Lab.
THE EFFECTS OF PRECIPITATION ON RADAR TARGET IDENTIFICATION AND IMAGING
D. B. Hodge Nov. 1975 20 p refs
(Grant NGR-36-008-080)
(NASA-CR-145744; TR-2374-19) Avail: NTIS HC $3.50 CSCL 17I

The properties of precipitation which will influence radar

system design are discussed. The spatial characteristics of rainfall and the sizes and shapes of raindrops are described. The dielectric behavior of water is combined with these characteristics to determine the effects of rain on electromagnetic waves. These effects include: absorption, scatter, noise emission, phase shift, and depolarization. Author

N76-11322*# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
DEFINITION OF THROW-AWAY DETECTORS (TADs) AND VLF ANTENNA FOR THE AMPS LABORATORY Interim Report, 25 Feb. - 26 Sep. 1975
H. C. Koons and J. F. Fennell 26 Sep. 1975 119 p refs
(Contract NAS8-31399)
(NASA-CR-144023; ATR-76(7520)-1) Avail: NTIS HC $5.50 CSCL 17B

A Throw Away Detector (TAD)/subsatellite to be used as an experiment platform for the test flights to map the EMI from the shuttle and during the AMPS science flights is defined. A range of instrument platforms of varying capabilities is examined with emphasis on the EMI test vehicle. The operational support requirements of TAD/subsatellites are determined. The throw away detector is envisioned as a simple instrument package for supporting specific experiments. Author

N76-11323# Mitre Corp., Bedford, Mass.
A COMPARISON OF TIME DIVISION MULTIPLEX DATA BUSES BASED ON COMPUTER SIMULATION
B. B. Mahler, R. A. Costa, and E. F. Boose May 1975 49 p refs
(Contract F19628-75-C-0001; AF Proj. 6370)
(AD-A012305; MTR-2960; ESD-TR-75-60) Avail: NTIS CSCL 17/2

This report compares waveforms, signal losses, and stub impedances for three computer simulated time division multiplex buses. Two of the simulations use coupling transformers to judiciously mismatch the stubs to the main bus. The third (and superior) configuration accomplishes the required mismatch by using a higher characteristic impedance wire for the stubs with no coupling transformer. GRA

N76-11324# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
PITCH AND VOICING IN SPEECH DIGITIZATION Final Report, 15 May 1973 - 15 May 1974
T. P. Barnwell, J. E. Brown, A. M. Bush, and C. R. Patisaul 15 Aug. 1974 264 p refs
(Contract F30602-72-C-0409)
(AD-A012307; E21-620-74-BU-1) Avail: NTIS CSCL 17/2

A critical element of any low or medium bit rate (16 kbps) speech digitization system is the pitch extraction and voicing mechanism. Any digitization system in this low to medium bit rate region will require a good pitch extraction technique as a key part of the system. In this study previous pitch extraction techniques are reviewed in the light of current pitch extraction requirements for speech digitization. Two promising new pitch extraction algorithms are suggested: the multiband pitch period estimation technique and the skip-sample recursive least squares pitch position estimation technique. The former gives only spacings between pitch pulses, while the latter gives registration of the pitch pulses with the speech waveform. GRA

N76-11325# Naval Postgraduate School, Monterey, Calif.
IMPLEMENTATION AND TESTING OF THE NPS DATA COMMUNICATIONS RING M.S. Thesis
John S. Meserve and Robert Stewart Jun. 1975 84 p refs
(AD-A012417) Avail: NTIS CSCL 17/2

The Naval Postgraduate School Ring Communication Network is a project which, when fully operational, will allow connection of designated computer facilities at the school. The capability provided to these facilities will be the transmission of data or messages to one another, which will allow sharing of resources. The main considerations in design of the network were modularity, to simplify construction and testing, and common hardware interfaces between the ring and each computer facility. To provide the capability to test all hardware/software functions test procedures were developed, and a hardware test module was constructed. The basic design of the ring network and test module is described. Test procedures and results are presented, as well as a proposal for a system modification, and recommendations concerning follow-on development of the system. GRA

N76-11326# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DIGITAL SIMULATION OF A SYNTHETIC APERTURE RADAR
A. D. Goldfinger Mar. 1975 162 p refs
(Contract N00017-72-C-4401)
(AD-A011831; APL/JHU-TG-1272) Avail: NTIS CSCL 17/9

To evaluate a synthetic aperture radar being designed for the SEASAT-A satellite a digital simulation was undertaken. A system operating in spotlight mode with step-chirp pulse compression was modeled. A bottleneck analysis of the software led to an economical implementation of this model. The ocean scattering model used assumed Rayleigh statistics. Ocean surface models representing chaotic seas and deterministic patterns, such at sea ice and oil slicks, were viewed by the radar. The effects of single-bit quantization of the signal, data thinning by random deletion of the signal, and coherent breakup of the image were investigated. Analytic models of image degradation owing to single-bit processing and image spectral distortion that is due to coherent breakup were developed and found to be consistent with the results of the simulation. GRA

N76-11327# Harry Diamond Labs., Adelphi, Md.
CONTRIBUTIONS TO THE THEORY OF WAVE PROPAGATION LONG WIRES ABOVE GROUND
Leo C. Levitt and Egon Mary Dec. 1974 40 p refs
(AD-A012178; HDL-TR-1693) Avail: NTIS CSCL 20/14

The problem of an infinite wire above a plane infinite ground has been investigated, with a view toward studying the types of waves that this structure can support with no incident radiation. It was found that, although a propagation constant can be meaningfully defined, the concepts of impedance and admittance per unit length cannot be simply generalized from transmission-line theory. The difficulty associated with the solutions of the two-dimensional Helmholtz equation is discussed, and the outgoing waves that increase in amplitude exponentially with the distance from the source are reasonably interpreted. GRA

N76-11328# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
SIMULATION OF A RADAR IMAGE FOR GARDEN CITY TEST SITE
S. K. Parashar, A. K. Fung, and R. K. Moore Feb. 1975 59 p refs
(Contract DAAK02-73-C-0106)
(AD-A012267; RSL-TR-234-8; ETL-0007) Avail: NTIS CSCL 17/9

This report documents and demonstrates in detail the procedure to be followed in digitally simulating a radar image for Garden City test site. The type of information needed for simulation and the method of actual construction of the image are presented. Simulated images both with and without fading are included. These images are produced for system parameters corresponding to Westinghouse AN/APQ-97 radar system. The simulated image is compared with the actual radar image of the area. The simulation of images for Garden City represents a first simulation effort for comparatively simple scene using relatively few system parameters. GRA

N76-11329# Mitre Corp., Bedford, Mass.
PRELIMINARY AFBITS NETWORK CONTROL SYSTEM
H. R. Clark, M. S. Cogan, H. I. Cohen, G. C. Dempsey, R. P. Witt, and I. H. Ziemba Jun. 1975 177 p refs
(Contract F19628-75-C-0001; AF Proj. 7040)
(AD-A012218; MTR-2925; ESD-TR-75-66) Avail: NTIS CSCL 17/2

This report describes a network control system for a coaxial cable based, multi-mode communication facility to be used for audio, video and data services on future Air Force Base communications installations. A detailed description is provided of the software for a minicomputer-based network control program and the hardware for a low cost out-of-band signaling and supervision system that can be frequency multiplexed on a broadband communications system. GRA

N76-11330# TRW Systems Group, San Bernardino, Calif. Minuteman Communications and Command Dept.
MINUTEMAN FSD COMMUNICATIONS STUDY REPORT Final Report
D. Vassilakos and T. R. Hooton May 1975 182 p
(Contract F04701-74-C-0327)
(AD-A012230; TRW-26048-1185-OTU-00; SAMSO-TR-75-122) Avail: NTIS CSCL 17/2

The present MINUTEMAN Cable Termination Equipment (CTE) design, most of which was developed in the 1950's using discrete components, was a good design for that era but by present (1975) standards it is large, sluggish and cumbersome. Thus, the goal of this program was to investigate the present state-of-the-art and to develop a reliable system with much improved performance using modern but proven techniques. Other design objectives were to increase hardness and decrease cost. A programmable processor was chosen to maximize operational efficiency, flexibility and growth capability. GRA

N76-11331# Nicolet Scientific Corp., Northvale, N.J.
STUDY AND DEVELOPMENT OF THE INTEL TECHNIQUE FOR IMPROVING SPEECH INTELLIGIBILITY Final Technical Report, Sep. 1973 - Dec. 1974
M. R. Weiss, E. Aschkenasy, and T. W. Parsons Apr. 1975 47 p refs
(Contract F30602-74-C-0058)
(AD-A011709; RADC-TR-75-108) Avail: NTIS CSCL 17/2

This report describes theoretical and experimental studies done to improve the performance of INTEL, a process for improving the signal-to-noise ratio of speech which has been corrupted by wideband noise. The theoretical study is a detailed statistical study of the process, showing how it works, why its effect on speech is different from its effect on noise, and why the cepstrum, a closely similar process, does not provide similar benefits. The experimental studies were explorations suggested by previous studies. These studies implemented various modifications to the basic process in the hope that they would improve its performance. The modifications were: Threshold clipping, Center clipping, Harmonic emphasis, and Adaptation to narrow-band speech. In addition, a number of experiments were conducted to study the effect of phase on speech intelligibility. GRA

N76-11332# Hughes Aircraft Co., Fullerton, Calif.
MISSILE SITE RADAR (MSR), UPGRADING PROGRAM. VOLUME 4: ACOUSTIC VELOCITY CORRELATOR Final Technical Report, 1 Sep. 1973 - 28 Feb. 1974
R. C. Knittle and T. W. Bristol Apr. 1975 32 p refs Sponsored in part by Army
(Contract F30602-71-C-0138)
(AD-A011776; FR-73-14-788-Vol-4; RADC-TR-73-347-Vol-4) Avail: NTIS CSCL 17/9

The object of the program is to determine the feasibility of implementing the velocity correlator network of a Pulse Burst Processor System using acoustic surface waves. The acoustic velocity correlator is a network of multiple tapped delay lines which corrects the Doppler time shifts of the output signals from a pulse burst correlator tapped delay line and sums the corrected signals in a single Doppler velocity channel. A 20 MHz bandwidth prototype device was developed during the first phase of the program. The goal of the current phase is to produce a 50 MHz design with improved performance. This report describes the development of improved velocity correlator equivalent circuit models which will be used to design the broadband prototypes. The accuracy of the models is validated by comparison on computed and measured data from the 20 MHz prototype device. GRA

N76-11333# Naval Postgraduate School, Monterey, Calif.
REDUCTION OF AUTODIN/NIDN LINE DISCIPLINES TO PROGRAMMED CONTROL LOGIC M.S. Thesis
Jane F. Renninger Jun. 1975 69 p refs
(AD-A012408) Avail: NTIS CSCL 17/2

In this design of a backup control for the OSIS (Ocean Surveillance Information System) Communication processor, the AUTODIN/NIDN (Navy Intelligence Data Network) line disciplines were analyzed and reduced to programmed control logic. The method of approach was developed then applied to the AUTODIN/NIDN protocol. A definition of 'state', as used in the context of the thesis, is presented, followed by detailed state transition tables and state diagrams. An instruction set of only three instructions was designed which can accomplish all the necessary tasks of the control logic. This instruction set was then used to program the Receive and Transmit control functions of the OSIS system. An implementation plan is presented to suggest possible ways the control unit can be made operational. GRA

N76-11334# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
WORD VERIFICATION IN A SPEECH UNDERSTANDING SYSTEM
Dennis H. Klatt May 1975 44 p refs
(Contract N00014-75-C-0533)
(AD-A012406; BBN-3082; AI-29) Avail: NTIS CSCL 17/2

A word verification component of a speech understanding system is intended to give a reliable yes/no decision as to whether a hypothesized word is present at a particular region of the acoustic input. A verification stage is a desirable system component because spectrogram-reading experiments have shown that preliminary acoustic-phonetic analyses are inherently ambiguous, whereas all the detailed acoustic cues must be consistent with a particular work hypothesis or the hypothesis can be rejected in a straight-forward way. The author proposes a word verification strategy in which a synthesis by rule program is used to predict the acoustic characteristics of a given word. This analysis-by-synthesis paradigm facilitates the statement of what are essentially generative phonological and phonetic rules. Spectral matching criteria and dynamic time normalization procedures are proposed for determining whether the synthesis matches the acoustic input. GRA

N76-11335# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SUMMARY OF RADIATION PATTERN MEASUREMENTS USING THE LES-7 LENS AND VARIABLE POWER DIVIDING VPD FEED NETWORK AT 7.68 GHz
Bing M. Potts 25 May 1975 29 p refs
(Contract F19628-73-C-0002)
(AD-A011946; TN-1975-37; ESD-TR-75-178) Avail: NTIS CSCL 09/5

A comparison between experimental and calculated radiation pattern data for a multiple-beam antenna is presented. The antenna consists of a waveguide lens aperture excited by a 19-element feed horn array and variable beamforming network. The pattern data presented vary from a narrow high-gain beam, equivalent to that of a steerable paraboloid, to the earth-coverage pattern of a wide coverage communication satellite. Also discussed are the results of the earth-coverage measurements when either one or two feeds are turned off so as to produce nulls in the earth-coverage pattern. Author (GRA)

N76-11336# Atlantic Research Corp., Alexandria, Va.
LONG RANGE SENSOR COMMUNICATION Final Technical Report
Charles B. Sykes and Richard G. Robertson May 1975 318 p refs
(Contract F30602-72-C-0427; AF Proj. 692B)
(AD-A011924; TR-PL-10132; RADC-TR-75-116) Avail: NTIS CSCL 17/2

A performance study was conducted to determine the feasibility of direct long-range remote sensor communications without the use of relays. Of the propagation modes analyzed, HF ionospheric, MF.HF ground-wave, and forward meteor scatter, the HF ionospheric propagation mode is favored and performance predictions using this mode for digital message transmission are presented. The performance is given in terms of predicted message error rate and circuit outage under various conditions of range, frequency, hour, season, sunspot number and geographic location. GRA

N76-11337# Dikewood Corp., Albuquerque, N.Mex.
SPHERICAL CAVITY RESONANT DAMPING THROUGH THE USE OF AN IMPEDANCE LOADED SHELL INSIDE THE CHAMBER Final Report, 28 Sep. 1973 - 31 Mar. 1974
Terry L. Brown Jun. 1975 173 p refs
(Contract F29601-74-C-0010; AF Proj. 4695)
(AD-A011937; AFWL-TR-74-255) Avail: NTIS CSCL 20/14

This report addresses itself to one aspect of a simulator

concept for simulating EMP in exoatmospheric regions by the incorporation of a spherical vacuum test chamber. Many important features affect the electromagnetic interactions of a space system with this type of spherical cavity. One of these is the problem of resonance. The report presents a complete parameter study of the resonant frequencies of a perfectly conducting spherical chamber with an inner spherically shaped impedance loaded damping structure. Frequency shifts are given for a wide range of damper location and loading. The resulting cavity damping is given for several lower order E and H modes. GRA

N76-11338# Naval Underwater Systems Center, New London, Conn.
PROJECT SANGUINE Quarterly Technical Summary Report, 1 Jul. - 30 Sep. 1974
6 Jun. 1975 27 p refs
(AD-A011824; NUSC-TR-4907) Avail: NTIS CSCL 17/2

The work reported includes field measurements concerned with extremely low frequency propagation, and distribution of powerline fields in the sea near New London, Connecticut. GRA

N76-11339# Army Electronics Command, Fort Monmouth, N.J.
COMPUTER AIDED MOBILE SHELTER DESIGN
George Panagos Jun. 1975 27 p
(AD-A012163; ECOM-4329) Avail: NTIS CSCL 17/2

The computer aided Mobile System Design project (MSD) for devising improved mobile communications-electronics (C-E) shelter/vehicular configurations analysis capability has been divided into four problem-oriented study tasks. This report documents Transport and Mobility Layout for this design area and discusses some of the program features for effective CAD. The MSD set of programs, implemented on the MEDEA Interactive Design Terminal allows the designer to use interactive graphics to accomplish dynamic placement of equipment in a shelter or vehicle. Given such shelter/vehicle and equipment inputs as name or ID, weight, dimensions and center of gravity coordinates, the program determines the center of gravity of the equipment assembly and tests for compliance with weight distribution and lateral stability requirements of ECOM Technical Requirement SCL-1280D. The program outputs: (1) weight, center of gravity coordinates and moment for each equipment, (2) combined weight and center of gravity coordinates, (3) percent lateral stability and overweight and (4) planview, curbside, roadside, and perspective views. GRA

N76-11340# Army Electronics Command, Fort Monmouth, N.J.
SIGNAL PROCESSING BY PARAMETRIC INTERACTIONS IN AN ACOUSTIC SURFACE WAVE DEVICE
Emanuel Fliegler May 1975 65 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A012162; ECOM-4312) Avail: NTIS CSCL 09/5

A tutorial study of the acoustic surface wave signal processor, also known as a convolver, is presented. Frequency conversion and time compression occur when an input signal is fed into one port of the device and a reference signal is fed into the other port of the device. The output from the third port is at the sum frequency, and is defined as the convolution or correlation function of the input signals. Several ways in which this device can be used for signal processing, particularly in performing correlation and Fourier transformation, are presented. Convolver theory is given, with best results shown for semiconductor devices. Experimental results given for the Fourier transformation processing, show a good relationship to theory, and prove that it is now possible to perform this function in real time with arbitrary waveshapes. The convolver can perform a large number of signal processing functions with one basic, three port, acoustic surface wave delay line configuration, a significant achievement in flexibility. Of greatest importance is the performance of these functions in real time. GRA

N76-11341# North Electric Co., Galion, Ohio. Government Products Div.
TWO/FOUR WIRE DIGITAL SUBSET Interim Report
May 1975 84 p refs
(Contract F30602-74-C-0300; AF Proj. 4519)
(AD-A011729; RADC-TR-75-130) Avail: NTIS CSCL 17/2

This interim technical report contains information regarding the transmission of digital signals over 2 wire transmission facilities on a full duplex basis, heretofore only possible over 4 wire transmission facilities. It covers the results derived from a study of wire transmission characteristics. Based on the results of this study, three techniques are described as potential candidates. They are as follows: (1) Frequency Division Multiplexing Technique; (2) Signal Superimposition Technique whereby digital signals traversing in opposite directions are shifted in such a manner that the outgoing digital signal transitions occur in the middle of an incoming digital stream thereby enabling both signals to be recovered; (3) Time Division Multiplexing Technique. The conclusions indicate that, although all three techniques described above are technically feasible, only 2 and 3 offer economical advantages. GRA

N76-11342# Naval Research Lab., Washington, D.C.
OVERVIEW OF DIGITAL SIGNAL PROCESSING THEORY Interim Report
Lawrence M. Leibowitz 20 May 1975 93 p refs
(AD-A011423; NRL-7870) Avail: NTIS CSCL 09/4

An overview of the theory of digital signal processing is presented here using key portions of the applicable technical literature. This can serve either as an introduction for those who desire to pursue the subject further or as a concise summary for those for whom more detailed investigation would be impractical. The discussion begins with a consideration of discrete systems and signals as well as their relationship to the continuous case. The realization of digital signal processing systems in the form of digital networks is presented. Theory and design of digital filters are discussed along with their relation to continuous filter characteristics. The discrete Fourier transform (DFT) and its efficient implementation in the form of the fast Fourier transform (FFT) are presented. Discrete convolution and correlation and the application of the FFT to their efficient implementation are described. Finally the quantization effects inherent in all digital signal-processing realizations are reviewed with respect to their influence on digital-filter and FFT outputs. GRA

N76-11498* City Coll. of the City Univ. of New York. Inst. of Oceanography.
THE SCIENTIFIC JUSTIFICATION OF A RADAR SCATTEROMETER AND A PASSIVE MICROWAVE SYSTEM ON SEASAT-A
Willard J. Pierson *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 95-98 refs (For availability see N76-11482 02-42)
(Contract NAS5-20041)
CSCL 17I

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-11343# Research Inst. of National Defence, Stockholm (Sweden).
TEMPERATURE COMPENSATED DIELECTRIC MICROWAVE RESONATORS Final Report, 15 Apr. - 31 Dec. 1974
H. Steyskal, Sr., L. D. Wernlund, and P. Charas Apr. 1975 48 p refs
(Contract ESTEC-1818/72-HP)
(ESA-CR(P)-663) Avail: NTIS HC $4.00

A study of temperature stabilized dielectric resonators was presented, including the results of an extensive literature search on ferroelectrics, the production and investigation of four different polycrystalline ferroelectrics, and theoretical and experimental studies on composite, temperature stabilized dielectric resonators. The four polycrystalline ferroelectrics had losses too high for their utilization in microwave resonators. Composite resonators were therefore made with low loss single crystals of LiNbO3 as the part with a positive temperature coefficient. Two different

types of ceramics with low loss and high dielectric constants were used as the compensating material. Two pairs of cylindrical S-band resonators were constructed, one of sandwich type, the other of coaxial type. The material combinations resulted in an effective permittivity of 54-59 and Q0-values in the order of 5500. Figures for temperature compensation and resonance frequencies were compared. The resonators were tested satisfactorily with continuous power up to 80 W. Author (ESA)

N76-11344# National Aeronautical Lab., Bangalore (India). Instrumentation Div.

A VOLTAGE CONTROLLED TWO PHASE FUNCTION-GENERATOR USING OP-AMPS

R. Viswanathan and S. Baghialakshmi May 1974 18 p ref
(NAL-TN-48) Avail: NTIS HC $3.50

The design of a function generator providing triangle, sine and square wave output voltages whose frequency can be controlled by an input voltage, was described. The basic unit is a triangle and square wave generator working on the closed loop principle. A phase shifter gives an additional triangular output at 90 deg, and a function generator shapes the triangular waves to sine. The frequency range is from 1 Hz to KHz with waveform distortion in the sine waves less than 1%. Author

N76-11345*# Texas Instruments, Inc., Dallas.

DEVELOPMENT OF COMPONENTS FOR AN S-BAND PHASED ARRAY ANTENNA SUBSYSTEM Final Report

Oct. 1975 152 p
(Contract NAS9-14485)
(NASA-CR-144532; D-51001) Avail: NTIS HC $6.75 CSCL 09A

The system requirements, module test data, and S-band phased array subsystem test data are discussed. Of the two approaches to achieving antenna gain (mechanically steered reflector or electronically steered phased array), the phased array approach offers the greatest simplicity and lowest cost (size, weight, power, and dollars) for this medium gain. A competitive system design is described as well as hardware evaluation which will lead to timely availability of this technology for implementing such a system. The objectives of the study were: to fabricate and test six engineering model transmit/receive microelectronics modules; to design, fabricate, and test one dc and logic multilayer manifold; and to integrate and test an S-band phased array antenna subsystem composed of antenna elements, seven T/R modules, RF manifolds and dc manifold. Author

N76-11346*# Scientific Translation Service, Santa Barbara, Calif.

HIGH POWER MOTORS FOR ELECTRIC MOTOR VEHICLES

R. Moser and B. Pinter Washington NASA Nov. 1975 38 p refs Transl. into ENGLISH from Bull. Ass. Suisse Elec. (Switzerland), v. 65, no. 5, 9 Mar. 1974 p 321-331
(Contract NASw-2791)
(NASA-TT-F-16662) Avail: NTIS HC $4.00 CSCL 09C

The use of the concept high power motor for driving motors in electric motor vehicles is explained with the aid of speed traction diagrams. Limiting electric and mechanical quantities are surveyed. The development of locomotive motors is described by means of an illustrative example dealing with multi-purpose locomotives for the Swiss railroad system. Advantages of collectorless three phase traction motors are pointed out.
Author

N76-11347*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

A SURVEY OF DESIGN METHODS FOR FAILURE DETECTION IN DYNAMIC SYSTEMS

Alan S. Willsky Nov. 1975 41 p refs
(Grants NGL-22-009-124; NsG-1112)
(NASA-CR-145695; ESL-R-633) Avail: NTIS HC $4.00 CSCL 09C

A number of methods for the detection of abrupt changes (such as failures) in stochastic dynamical systems were surveyed. The class of linear systems were emphasized, but the basic concepts, if not the detailed analyses, carry over to other classes of systems. The methods surveyed range from the design of specific failure-sensitive filters, to the use of statistical tests on filter innovations, to the development of jump process formulations. Tradeoffs in complexity versus performance are discussed.
Author

N76-11348*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

STRUCTURAL PROPERTIES AND ESTIMATION OF DELAY SYSTEMS Ph.D. Thesis

Raymond H.-S. Kwong Sep. 1975 205 p refs
(Grants NGL-22-009-124; NSF GK-41647)
(NASA-CR-145698; ESL-R-614) Avail: NTIS HC $7.75 CSCL 09C

Two areas in the theory of delay systems were studied: structural properties and their applications to feedback control, and optimal linear and nonlinear estimation. The concepts of controllability, stabilizability, observability, and detectability were investigated. The property of pointwise degeneracy of linear time-invariant delay systems is considered. Necessary and sufficient conditions for three dimensional linear systems to be made pointwise degenerate by delay feedback were obtained, while sufficient conditions for this to be possible are given for higher dimensional linear systems. These results were applied to obtain solvability conditions for the minimum time output zeroing control problem by delay feedback. A representation theorem is given for conditional moment functionals of general nonlinear stochastic delay systems, and stochastic differential equations are derived for conditional moment functionals satisfying certain smoothness properties. Author

N76-11349*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

THE 121.75 MHz BAND PASS FILTER

R. J. Davis Sep. 1975 14 p
(Contract NAS9-12200)
(NASA-CR-144553; LEC-6995; JSC-09971) Avail: NTIS HC $3.50 CSCL 09C

Prior to the ASTP joint flight it was observed during various tests on the USA's VHF/FM system, that the 121.75 MHz receiver unsquelched when exposed to certain RF power levels at a frequency of 142.417 MHz. Tests were conducted in an effort to arrive at a solution. Several recommendations were made but the most feasible was to insert a selective band pass filter in the transmit/receiver line of the VHF/FM transceiver. The tests were performed on the filter to determine the frequency response and rejection capabilities at 142.417 MHz. Author

N76-11350# Joint Publications Research Service, Arlington, Va.

STANDARDIZATION IN RADIO-ELECTRONICS

V. V. Boytsov, ed. 21 Jul. 1975 189 p refs Transl. into ENGLISH from Standartizatsiya v Radioelektronike (Moscow), 1971
(JPRS-65270-1) Avail: NTIS HC $7.50

An examination is presented of the general problems of standardization in radio-electronics, the principal directions of research, the categories and forms of standards, and the requirements imposed on the quality and reliability of products. The problems of standardizing the components and units of radio apparatus, and standardization of electronic and radio devices and communication resources were examined. For Part 2, see N75-30389. Author

N76-11351# Royal Aircraft Establishment, Farnborough (England).

AN AMPLIFIER WITH AUTO-RANGING CAPABILITIES FOR USE IN AIRBORNE TRIALS

D. Thomas Apr. 1975 39 p refs
(RAE-TR-75033; BR47516) Avail: NTIS HC $4.00

An amplifier for use in aircraft on missile trials for instrumentation purposes is described which can assess the amplitude of the signal and set the optimum gain. The design is discussed with regard to amplifier performance (particularly with respect to common mode rejection), methods of gain changing, peak detection, and gain value transmission. A practical application is described together with some suggestions for future development. Author (ESA)

N76-11352# Hawker Siddeley Dynamics Ltd., Hatfield (England). Space Div.

GUIDELINES FOR SPACECRAFT POWER AND SIGNAL CABLING
Paris ESA Jan. 1975 209 p refs
(Contract ESTEC-2063/73-AK)
(ESA-CR(P)-658) Avail: NTIS HC $7.75

The design of cable harnesses for manned and unmanned spacecraft was discussed. Useful references and specifications most commonly used were collected and requirements for interfaces examined. Guidelines for the design and installation of power, signal, and pyrotechnic harnesses are given. The emphasis is on round wire harnesses with some information on flat conductor cabling. Parametric data for the selection of wire/cable and connectors and insulations are presented and a list of European manufacturers is included. Manufacture and standard repair methods are recommended and processes for mechanical stripping of wire and cable discussed. Cable harness testing is presented in standard format. ESA

N76-11353# Naval Ordnance Station, Louisville, Ky.
DEVELOP MAGNETIC COIL DESIGN AND MANUFACTURING CAPABILITY Final Report
Thomas E. Alves Nov. 1974 58 p
(AD-A012367; NOSL-MT-022) Avail: NTIS CSCL 09/1

This project describes how the theory, design, and manufacturing knowledge have been acquired and used to develop an in-house capability for the fabrication of magnetic forming coils. The major sub-tasks of familiarization, equipment and material acquisition, and development work are described. Four expansion coil descriptions are given, together with manufacturing and testing procedures. A typical air-cooled, electromagnetic expansion coil is illustrated, together with a sequential description of fabrication. GRA

N76-11354# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DEVELOPMENT OF TECHNOLOGY FOR ASSESSMENT OF ELECTROMAGNETIC COUPLING: ENCLOSURE COUPLING
27 Nov. 1974 50 p refs
(Contract N00178-74-C-0524)
(AD-A012360; MDCE-1178) Avail: NTIS CSCL 09/1

The trend to higher powered radiating equipment on the one hand, and to more sensitive solid state components on the other hand, is the motivation for the High Power Effects Program. The effort to determine adverse effects on electronic systems due to high power environments which are indigenous to Naval operations has three divisions: radio frequency environment, coupling from the environment to components, and the effects of radio frequency energy on the components. This report discusses an investigation of the coupling of microwave radiation to loads terminating cables inside enclosures that have discontinuities. GRA

N76-11355# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
LOCALIZATION OF FAILURES IN RADIO CIRCUITS, A STUDY IN CAUSAL AND TELEOLOGICAL REASONING
Allen L. Brown and Gerald Jay Sussman Dec. 1974 31 p refs
(Contract N00014-70-A-362-0005)
(AD-A011839; AI-M-319) Avail: NTIS CSCL 17/2

The paper examines some methodologies for diagnosing correctly designed radio circuits which are failing to perform in the intended way because of some faulty component. Particular emphasis is placed on the utility and necessity of good teleological descriptions in successfully executing the task of isolating failing components. GRA

N76-11356# Hughes Research Labs., Malibu, Calif.
HIGH CURRENT CROSSED-FIELD TUBE DEVELOPMENT Final Technical Report, 19 Apr. 1974 - 18 Apr. 1975
Robin J. Harvey and Michael A. Lutz May 1975 63 p
(AD-A011850) Avail: NTIS CSCL 09/1

A crossed-field tube has successfully interrupted 10 kA against 100 kV without the use of a voltage recovery rate limiting capacitor. A smaller diameter tube, specifically constructed for this program interrupted 7.8 kA against 100 kV. These results confirm a semi-empirical scaling law which predicts the peak interruptable current level I(kA) + r(cm)/3 where r is the mean electrode radius. Experiments using dual anode feedthrough bushings to reduce the self-magnetic field did not prove effective, indicating that this field may not be responsible for the current limitation. Double pulse interruptions were accomplished at 5.9 kA against 66 kV with an interpulse time of 16.7 msec (to approximate 50 Hz operation). No difficulties were encountered under these conditions indicating that repetitive operation does not cause significant gas pressure fluctuations. Also, dissipation calculations and measurements were made for a 100 microsec square current pulse interrupted against 100 kV. The dissipated energy per shot was found to be 250 J/kA. GRA

N76-11357# Mitre Corp., Bedford, Mass.
MULTIPLEX BUS DATA WAVEFORM SPECTRA
J. Maeks May 1975 36 p refs
(Contract F19628-75-C-0001; AF Proj. 6370)
(AD-A011711; MTR-2963; ESD-TR-75-64) Avail: NTIS CSCL 17/2

The paper contains a derivation of the formula for the average energy spectral density of a multiplex bus data word. It also contains graphs of the spectral density and the cumulative distribution of energy versus frequency. GRA

N76-11358# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
THE 1.06 MICROMETER HIGH SENSITIVITY IR PHOTOCATHODE Final Report, 2 Jan. - 2 Oct. 1974
J. S. Harris, Jr. and R. Sahai Jan. 1975 72 p refs
(Contract F33615-74-C-1085; AF Proj. 2001)
(AD-A011694; SC575.10TR; AFAL-TR-74-341) Avail: NTIS CSCL 09/1

The design and progress towards a field-assisted double heterojunction photocathode with high quantum efficiency at 1.06 micrometers is reported. The basic device design was developed and the concept feasibility was demonstrated in a preceeding program. In this program the authors have further improved the design and achieved uniform and reproducible performance from the test devices. Internal electron transport efficiencies approaching 70 percent have been measured. However, the external quantum efficiency at 1.06 micrometers is low due to an unfavorable bandgap grading in the GaAsSb absorber layer. Further work to optimize the device design is recommended to realize the great potential of this double heterojunction structure for field-assisted photoemission. GRA

N76-11359# Radio Corp. of America, Princeton, N.J.
TRANSFERRED-ELECTRON-DEVICE (TED) TECHNOLOGY IMPACT STUDY Final Report, 1 Oct. 1974 - 31 Mar. 1975
Markus Nowogrodzki and S. Yegna Narayan Jun. 1975 53 p refs
(Contract N00014-75-C-0077; NR Proj. 383-022; RF54545003)
(AD-A011802; PRRL-75-CR-24) Avail: NTIS CSCL 09/1

The objective of the overall program reviewed in the report was the assessment of the impact of a new technology - that of signal processing by means of transferred-electron devices (TEDs) - on a particular class of systems of interest to the U.S. Navy. This volume contains the findings of the first task; it describes the state-of-the-art of transferred electron devices used for signal processing purposes, and it provides projections of short-range progress in the device and system technologies. GRA

N76-11360# Naval Intelligence Support Center, Washington, D.C. Translation Div.
SOLENOID ASSEMBLY FOR OBTAINING SUPERSTRONG MAGNETIC FIELDS
V. G. Veselago, L. P. Maksimov, and A. M. Prokhorov 22 May 1975 10 p Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (USSR), no. 12, 1968 p 58-62
(AD-A012076; NISC-Trans-3673) Avail: NTIS CSCL 14/2

The solenoid assembly for obtaining superstrong d-c magnetic fields has been in operation in the P. N. Lebedev Institute of Physics for more than a year. Two methods are used to obtain superstrong d-c magnetic fields. The first consists in passing a strong current through a coil which is cooled by some kind of liquid, the liquid usually being water. This method requires large

amounts of electrical energy. The second method, which is based on the use of a superconducting solenoid, is free of this shortcoming, as only small amounts of power are needed. However, the first method was selected. GRA

N76-11361# Lincoln Lab., Mass. Inst. of Tech., Lexington.
WINDING A LONG COIL WITH A PRE-PROGRAMMED TURNS DENSITY VARIATION
Michael L. Burrows and S. Hardy Prince 27 May 1975 22 p refs
(Contract F19628-73-C-0002; AF Proj. 1511)
(AD-A011948; TN-1975-30; ESD-TR-75-176) Avail: NTIS CSCL 09/5

A conventional cable manufacturer's concentric taping machine was modified to wind a long solenoidal winding with a smooth pre-programmed turns density variation. An interpolating function generator with many adjustable set points was used to define the function of coil length that the turns density is to follow. A machine having this capability is needed to provide a towed ELF loop antenna with the smoothly tapered sensitivity variation it requires to discriminate against vibration noise.
Author (GRA)

N76-11362# Radio Corp. of America, Princeton, N.J.
BASIC ADHESION MECHANISMS IN THICK AND THIN FILMS Final Report, 1 Jan. - 31 Dec. 1974
Thomas T. Hitch and Kenneth R. Bube 31 Jan. 1975 226 p refs
(Contract N00019-74-C-0270)
(AD-A011906; PRRL-75-CR-3) Avail: NTIS CSCL 09/1

Seventeen commercial, gold-based thick-film conductor inks and four alumina substrates (two each, 96 and 99.5 wt pct) were characterized physically and chemically. These characterizations were performed on as-received materials. Films were screen-printed and singly fired and refired 5 times in accordance with manufacturer recommendations commensurate with thick-film hybrid microelectronic usage; adhesion strength, conductivity, and other properties of the films were measured and are reported. GRA

N76-11363# Stanford Univ., Calif. Microwave Lab.
MICROWAVE ACOUSTIC AND BULK DEVICE TECHNIQUE STUDIES Interim Report, 1 May - 31 Oct. 1974
May 1975 26 p ref
(Contract F30602-74-C-0038; AF Proj. 5573)
(AD-A011930; ML-2401; RADC-TR-75-140) Avail: NTIS CSCL 09/1

This report is the second Interim Technical Report on the contract. It covers research done on acoustic surface wave devices during the six month period 1 May to 31 October 1974. The objective of the research is the generation of new device concepts and the analytical and experimental verification as to their ultimate usefulness for signal processing applications. Improvements were made in acoustic surface wave convolver efficiency. The surface wave convolver can be used for performing convolution/correlation, time reversal and Fourier analysis of arbitrary signals. A new approach which may lead to low cost, simplified analog/digital conversion has been devised. This combines a surface acoustic wave delay line and external digital circuitry.
GRA

N76-11364# Naval Research Lab., Washington, D.C.
BROADBAND, HIGH-PERFORMANCE COUPLERS WITH DIELECTRIC OVERLAYS FOR MICROWAVE INTEGRATED-CIRCUIT APPLICATIONS
Boris Sheleg and Barry E. Spielman 28 May 1975 44 p refs
(NRL Proj. R08-63; NRL Proj. R06-33C; RR0210346)
(AD-A011814; NRL-7872) Avail: NTIS CSCL 09/1

A systematic design approach is used to develop a class of high-performance, broadband, directional couplers for microwave integrated-circuit application. The couplers are characterized by two asymmetric quarter-wavelength coupling sections covered by dielectric overlays. All design parameters of these couplers, except the overlay thickness, are determined by computer analysis. This approach, which minimizes the empirical operations and improves the predictability and repeatability, results in a coupler design suitable for integrated systems production. The design, fabrication, and evaluation of 6-, 10-, and 20-dB directional couplers is presented. The measured and predicted performance characteristics of these couplers compare well and demonstrate the use of this systematic coupler-design approach. Sufficient design detail and discussion is included to permit reproduction of these dielectric-overlay couplers. GRA

N76-11365# Naval Civil Engineering Lab., Port Hueneme, Calif. Naval Construction Battalion Center.
PROTOTYPE POWERLINE TRANSIENT SOURCE AND DIRECTION OF PROPAGATION DETECTOR Final Technical Note, Jul. 1973 - Sep. 1974
M. N. Smith and K. T. Huang May 1975 22 p
(YF53534005)
(AD-A011809; CEL-TN-1388) Avail: NTIS CSCL 09/1

Random impulse voltage transients that occur on electrical power distribution systems can cause physical damage to critical loads, resulting in operational failure. There are numerous transient detection devices, but until recently no device could determine the direction of propagation of transients on a powerline. This report is an evaluation of two prototype transient-direction detectors. Tests revealed they provide a simple and accurate means of locating the source of impulse transients on electrical powerlines. GRA

N76-11366# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ERROR ANALYSIS OF A VARIABLE-POWER DIVIDER
Leon J. Ricardi 9 Jun. 1975 26 p ref
(Contract F19628-73-C-0002)
(AD-A011949; TN-1975-32; ESD-TR-75-186) Avail: NTIS CSCL 09/1

Errors in the division of power by a variable-power divider using phase shifters and a pair of 3-dB couplers are determined as a function of an incorrect setting of the phase shifters. The insertion phase, of the phase shifters, is assumed to have a Gaussian distribution about the desired value and the resultant probability distribution of the power division is calculated. Curves are given for the probability that P sub A falls within a given error. These curves are computed from the probability density function of P sub A which is also shown graphically. GRA

N76-11367# Ohio State Univ., Columbus. ElectroScience Lab.
MEASUREMENT OF THE POWER HANDLING CAPABILITY OF RESONANT SLOT ARRAYS
G. W. Doyle and R. D. Fulton Apr. 1975 18 p refs
(Contract F33615-73-C-1173)
(AD-A011933; ESL-3622-1; AFAL-TR-75-27) Avail: NTIS CSCL 09/1

This report is a summary of an investigation to determine the incident power density which a resonant slot array can handle without causing permanent structural damage. The effect of altitude, varying the slot width, and also encasing the element in dielectric was measured for several different types of reactively loaded slots as well as circular slots. The effect of varying the element-to-element spacing in the array is explained. The significance of this research to the Air Force is that it provides guidelines for the design of periodic slotted surfaces as used in metallic radomes, subreflectors for cassegrain antennas, and space filters in general. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-11368*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
BILATERAL CHARACTER OF ACOUSTIC ACTION ON FREE TURBULENT JETS
Ye. V. Vlasov and A. S. Genevskiy Washington NASA Nov. 1975 10 p refs Transl. into ENGLISH from the book "Turbulentnyye Techeniya" Moscow, Nauka Press, 1974

p 149-153
(Contract NASw-2789)
(NASA-TT-F-16658) Avail: NTIS HC $3.50 CSCL 20D

The influence of sound having various intensities and frequencies on the aerodynamic characteristics of turbulent jets was studied. In particular, the effects on the mean flow velocity, the longitudinal and transverse components of the pulsation velocity, and the turbulence spectrum were investigated. Author

N76-11369*# Transemantics, Inc., Washington, D.C.
LIFT HEIGHT OF VAPOR BUBBLES IN AN UNDERHEATED LIQUID DURING BOILING AT VERTICAL WALLS
L. M. Moroz and A. S. Danilov Washington NASA Sep. 1975 15 p refs Transl. into ENGLISH from Inzh. Fiz. Zh. Akad. Nauk Belorussk. SSR (Minsk), v. 28, Mar. 1975 p 495-502
(Contract NASw-2792)
(NASA-TT-F-16572) Avail: NTIS HC $3.50 CSCL 20D

The average height of ascent of vapor bubbles in underheated alcohol was studied during boiling at vertical aluminum walls. Calculations of the ascent velocity of a gas bubble in a liquid at Reynolds numbers up to approximately 20 were made in the Oseen approximation, and the rate of collapse of a vapor bubble was estimated. Author

N76-11370*# Kanner (Leo) Associates, Redwood City, Calif.
A MATHEMATICAL MODEL FOR HEAT AND MATERIAL EXCHANGE IN BUBBLES
K. Kovansky Washington NASA Oct. 1975 103 p refs Transl. into ENGLISH from the book "Ein Mathematisches Modell fuer den Waerme- und Stoffaustausch bei Blassen" Zurich, Eidgenoessische Technische Hochshule, 1968 134 p
(Contract NASw-2790)
(NASA-TT-F-16626) Avail: NTIS HC $5.50 CSCL 20M

A mathematical model is formulated for heat and material exchange in bubbles which form at a nozzle and then rise in an otherwise still liquid. The hydrodynamics of the flow are assumed to be known, and their effect as a result of combined laminar and turbulent surface renewal is taken into account. The exchange process is considered in three stages: (1) bubble formation, (2) transition period, and (3) quasi-stationary bubble rise. A mathematical solution is derived for the first and third stage on the basis of similar assumptions, and indications as to how to estimate the exchange process in the transition period are presented. Author

N76-11371*# Transemantics, Inc., Washington, D.C.
MOTION AND FILLING OF CAVITIES IN AN UNBOUND LIQUID NEAR A PLANE
V. V. Voinov and O. F. Voinov Washington NASA Sep. 1975 13 p refs Transl. into ENGLISH from Zh. Prikl. Mekh. Tekh. Fiz. (USSR), Jan.-Feb. 1975 p 89-95
(Contract NASw-2792)
(NASA-TT-F-16571) Avail: NTIS HC $3.50 CSCL 20D

Projection type methods were applied to the problem of a cavity in an ideal incompressible liquid in the absence of vortices. The collapse of a bubble having an initial velocity in an unbounded liquid and of a stationary bubble near a solid wall is considered. The small-parameter method was used for an analytical study of generation of a jet. A numerical calculation method not related to small parameters and based on the calculation of the projection by a numerical computation of the corresponding integrals was developed. The method combines an economy and simplicity of application with a high degree of accuracy in the region where the representation of the velocity potential by a series in spherical functions is effective. Author

N76-11372*# Transemantics, Inc., Washington, D.C.
MOTION OF GAS BUBBLES IN A LIQUID UNDER THE INFLUENCE OF A TEMPERATURE GRADIENT
V. M. Kuznetsov, B. A. Lugovtsov, and Ye. I. Sher Washington NASA Sep. 1975 6 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), Jan. - Feb. 1966 p 124-126
(Contract NASw-2792)
(NASA-TT-F-16569) Avail: NTIS HC $3.50 CSCL 20D

Experimental and theoretical analysis is presented of the motion of a gas bubble arising as a result of surface tension force in a weightless, viscous fluid with a temperature gradient. The theory of the steady-state motion of a bubble in a temperature field with a constant gradient in the case of small Reynolds numbers is given. Results of an experiment are in qualitative agreement with this theory. Author

N76-11373*# Transemantics, Inc., Washington, D.C.
PRESENTATION AND DISCUSSION OF RESULTS FROM MEASUREMENTS OF THE VELOCITY OF SLIDING GAS BUBBLES IN A LIQUID MEDIUM, CARRIED OUT BY DIFFERENT METHODS
A. Campanile, G. Galimi, M. Goffi, U. Magrini, and C. Pisoni Washington NASA Oct. 1975 16 p refs Transl. into ENGLISH from Soc. Ric. Impianti Nucl., Rept. SORIN-145 Saluggia, 1968 p 1-10
(Contract NASw-2792)
(NASA-TT-F-16616; Rep-SORIN-145) Avail: NTIS HC $3.50 CSCL 20D

Comparisons were made of the different methods used the measure the velocity of gas bubbles in a liquid medium. Of the methods compared, the radioactivation method did not appreciably change the physical and chemical properties of the gas which influences the bubble movement. The technique employed outflowing argon bubbles in stagnant water, and can be used to study the motions of bubbles in metal ducts if visualization or optical techniques are inapplicable. Author

N76-11374# Virginia Polytechnic Inst. and State Univ., Blacksburg. Aerospace and Ocean Engineering.
SIMPLIFIED ANALYSIS OF SUPERSONIC BASE FLOWS INCLUDING INJECTION AND COMBUSTION
J. A. Schetz, F. S. Billig, and S. Favin Sep. 1975 32 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Jan. 1976 sponsored by Navy
(VPI-Aero-039) Avail: NTIS HC $4.00

Important physical processes are examined such as viscous-inviscid interaction, turbulent transport, recirculation, the interaction of the body boundary layer with the corner expansion, and heat release. Predictions compare favorably with experiment and more complex analyses over a wide range of conditions in terms of base pressure. Computer execution time for a total flow field calculation approximates 10 seconds on an IBM 360/91. Author

N76-11375# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR THE CAMINAR SUPERSONIC FLOW OVER A TWO-DIMENSIONAL BACKWARD FACING STEP
Y. Kronzon, A. Seginer, and J. Rom Dec. 1974 60 p refs
(TAE-237) Avail: NTIS HC $4.50

Numerical solutions are presented for the steady two-dimensional laminar supersonic flow over a backward facing step. The compressible time-dependent Navier-Stokes equations are expressed in a conservation form and solved by employing an explicit finite differences scheme. An interative relaxation technique leads to the steady state solution. The unknown boundary conditions were determined by an extrapolation procedure, thus reducing the required size of the computed region. Solutions were obtained for Reynolds numbers (based on the step height) in the range of 200 to 16,000 at Mach numbers 2.25 to 3.50, for the cases of adiabatic and nonadiabatic walls. The calculation program allows for arbitrary values of the ratios of the boundary layer thickness at the step corner to the step base height. In the present case the values of 0.325 and 0.112 were used and the calculated results are compared with relevant experimental data. Author

N76-11376# Glasgow Univ. (Scotland). Dept. of Aeronautics and Fluid Mechanics.
TURBULENCE WITH SOLID BODIES
H. Reichardt Dec. 1973 36 p Transl. into ENGLISH from German report
(Rept-7302) Avail: NTIS HC $4.00

An apparatus was built in which an approximately plane free turbulent jet mixture of water and cylindrical bodies may be obtained. Values of the local flow velocity throughout the stream may be determined by photographic exposures of the

movements of the solid bodies. Results obtained so far seem to indicate that this solid body turbulence lends itself to the investigation of turbulence structure in fluids. The bodies are made of plastic, have the same specific gravity as water, and have a diameter of 2.2 cm with an axial height of 1.9 cm.
Author

N76-11377*# Kanner (Leo) Associates, Redwood City, Calif.
MOTION OF A FLUID WITH GAS BUBBLES
S. S. Bishay Khanna Washington NASA Nov. 1975 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 6, Nov.-Dec. 1971 p 111-116
(Contract NASw-2790)
(NASA-TT-F-16665) Avail: NTIS HC $3.50 CSCL 20D

A class of continuous medium models is derived whose energy depends on the temperature, the density, and the rate of density variation. This class of models includes Kogarko's model for a cavitating fluid and the conditions at the discontinuities were determined. Kogarko's model is formulated for a fluid containing gas bubbles. The propagation of small disturbances is analyzed. Exact solutions to problems involving one-dimensional steady and unsteady motions of a fluid/bubble mixture in a tube were obtained. Author

N76-11378*# Scientific Translation Service, Santa Barbara, Calif.
THE FLOW OF INDIVIDUAL CYLINDRICAL GAS BUBBLES IN VERTICAL CIRCULAR TUBES Ph.D. Thesis
Dimitris Kouremenos Washington NASA Nov. 1975 134 p refs Transl. into ENGLISH from Eidgenoess. Tech. Hochschule, (Zurich, Switzerland), 1967 123 p
(Contract NASw-2791)
(NASA-TT-F-16655) Avail: NTIS HC $6.00 CSCL 20D

The two phase flow of cylindrical air bubbles in a vertical pipe stream was studied by measurements on pressure gradients and wall friction velocity as well as calculations for bubble shape, bubble skin thickness and friction. It was found that the pressure differences caused by traveling air bubbles were 10 to 32% larger than comparable values for similar immovable gas volumes. Increased bubble viscosity also increased skin thickness and pressure differences. Author

N76-11379*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC HEATING TO THE GAPS AND SURFACES OF SIMULATED REUSABLE-SURFACE-INSULATION TILE ARRAYS IN TURBULENT FLOW AT MACH 6.6
Irving Weinstein, Don E. Avery, and Andrew J. Chapman Washington Nov. 1975 52 p refs
(NASA-TM-X-3225; L-10188) Avail: NTIS HC $4.50 CSCL 01A

An experimental investigation was made on a simulated reusable-surface-insulation tile array in a turbulent boundary layer to determine aerodynamic-heating distributions representative of those expected on the surface of the shuttle orbiter during earth entry due to the presence of longitudinal and transverse surface gaps. The tests were conducted in an 8-foot high-temperature structures tunnel in a test medium of methane-air combustion products at a nominal Mach number of 6.6 and over a free-stream Reynolds number range from 2,000,000 to 4,900,000 per meter (600,000 to 1,500,000 per foot). The results were used to assess the aerodynamic heating effects produced by parameters that include gap width, boundary-layer displacement thickness, in-line and staggered tile arrangement, and tile protrusion. Author

N76-11380# Advisory Group for Aerospace Research and Development, Paris (France).
COMPUTATION OF VISCOUS COMPRESSIBLE FLOWS BASED ON THE NAVIER-STOKES EQUATIONS
Roger Peyret, Henri Viviand, and J. J. Smolderen, ed. Sep. 1975 50 p refs
(AGARD-AG-212; AGARDograph-212) Avail: NTIS HC $4.00

Problems relating to the computation of viscous compressible flows based on numerical solutions of the Navier-Stokes equations are reviewed. A general introduction to the Navier-Stokes equations and a discussion of their interest in aerodynamic problems are presented. The following aspects of numerical methods are considered: limitation of the computational domain and boundary conditions on the outer boundary; various approaches in finite difference methods and description of some representative schemes; treatment of boundary conditions at a solid wall; treatment of shock waves; and general considerations on accuracy and computing times. Reported computations of two-dimensional or three-dimensional flows are presented in table form with summary indications on the problems treated and the methods used. Author

N76-11381*# Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENT OF SUGDEN'S PARAMETER WITH SIMPLE LIQUID AS A FUNCTION OF TEMPERATURE Thesis
Hendrik L. Gielen Washington NASA Oct. 1975 137 p refs Transl. into ENGLISH of the book "Metingen van de Parameter van Sugden van Eenvoudige Vloeistoffen als Funktie van de Temperatuur" Belgium, 1974 p 1-164
(Contract NASw-2790)
(NASA-TT-F-16550) Avail: NTIS HC $6.00 CSCL 20M

Sugden's parameter was measured for argon, methane, nitrogen, oxygen, and carbon dioxide over a large temperature variation. An extended capillary ascent method employing flat capillaries and schlieren lighting was used. The theory and numerical methods for the computation of Sugden's parameter were discussed. The experimental results were compared with those of earlier investigators. Author

N76-11382*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FINITE ELEMENT COMPUTATION OF A VISCOUS COMPRESSIBLE FREE SHEAR FLOW GOVERNED BY THE TIME DEPENDENT NAVIER-STOKES EQUATIONS
Charlie H. Cooke and Doris K. Blanchard Oct. 1975 60 p refs Prepared in cooperation with Old Dominion Univ. Res. Found.
(Grant NsG-1098)
Avail: NTIS HC $4.50 CSCL 20D

A finite element algorithm for solution of fluid flow problems characterized by the two-dimensional compressible Navier-Stokes equations was developed. The program is intended for viscous compressible high speed flow; hence, primitive variables are utilized. The physical solution was approximated by trial functions which at a fixed time are piecewise cubic on triangular elements. The Galerkin technique was employed to determine the finite-element model equations. A leapfrog time integration is used for marching asymptotically from initial to steady state, with iterated integrals evaluated by numerical quadratures. The nonsymmetric linear systems of equations governing time transition from step-to-step are solved using a rather economical block iterative triangular decomposition scheme. The concept was applied to the numerical computation of a free shear flow. Numerical results of the finite-element method are in excellent agreement with those obtained from a finite difference solution of the same problem. Author

N76-11383*# Dynatherm Corp., Cockeysville, Md.
JET PUMP ASSISTED ARTERY Final Report
31 Oct. 1975 39 p refs Sponsored by NASA
(NASA-CR-137778; DTM-75-6) Avail: NTIS HC $4.00 CSCL 20M

A procedure for priming an arterial heat pump is reported; the procedure also has a means for maintaining the pump in a primed state. This concept utilizes a capillary driven jet pump to create the necessary suction to fill the artery. Basically, the jet pump consists of a venturi or nozzle-diffuser type constriction in the vapor passage. The throat of this venturi is connected to the artery. Thus vapor, gas, liquid, or a combination of the above is pumped continuously out of the artery. As a result, the artery is always filled with liquid and an adequate supply of working fluid is provided to the evaporator of the heat pipe. Author

N76-11384# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A NOTE ON THE DISTORTION OF A MAGNETIC FIELD BY THE NON-ALIGNED FLOW OF AN INFINITELY CONDUCTING FLUID PAST A CIRCULAR CYLINDER
R. Smith Jan. 1975 10 p refs
(MATHS-Res-50) Avail: NTIS HC $3.50

The two-dimensional, steady motion of an infinitely conducting

incompressible fluid past a fixed nonconducting cylinder is considered for the case when the angle between the fluid velocity and magnetic field is aligned at a nonzero angle. Infinitely conducting fluids are important in a practical sense, since the flow of the solar wind past the earth is often modelled by them. The example of flow past a circular cylinder is examined for nonaligned lines of magnetic force and fluid velocity. It is shown that the aligned flow solution does not represent the limit of the nonaligned solution. ESA

N76-11385# Loughborough Univ. of Technology (England). Dept. of Mathematics.

DISTORTION OF A NON-ALIGNED MAGNETIC FIELD BY THE FLOW OF AN INVISCID CONDUCTING FLUID PAST A CIRCULAR CYLINDER

R. Smith Jun. 1975 22 p refs
(MATHS-Res-66) Avail: NTIS HC $3.50

The distortion of a magnetic field by the flow of a conducting fluid past a cylinder of the same permeability was found for small and infinite values of the magnetic Reynolds number. For small values good agreement was obtained with the results of Seebass and Tamada when the flow is aligned with the field at large distances from the body. For infinite magnetic Reynolds number, all the lines of force are dragged into the cylinder and upstream and downstream wake regions are present on the axis of the flow. Author (ESA)

N76-11386# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

CONDITIONAL SAMPLING

J. P. Schon (Ecole Centrale de Lyon) and G. Charnay (Ecole Centrale de Lyon) 1975 60 p refs Presented at the VKI Lecture Series 73 on Meas. of Unsteady Fluid Dyn. Phenomena, Rhode-Saint-Genese, Belg., 27-31 Jan. 1975
Avail: NTIS HC $4.50

The different intermittent phenomena in flows and their measurement by conditional sampling methods are considered. Some of the different intermittencies that can be defined in flows are reviewed, and general definitions are given. Detection criteria and measurement techniques are analyzed in detail for boundary intermittency. Some experimental results are given on the intermittent structure of the boundary of a turbulent boundary layer. Author (ESA)

N76-11387# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

THE HOT-WIRE AND THE HOT-FILM ANEMOMETERS

G. Comte-Bellot (Ecole Centrale de Lyon) 1975 61 p refs Presented at the VKI Lecture Series 73 on Meas. of Unsteady Fluid Dyn. Phenomena, Rhode-Saint-Genese, Belg., 27-31 Jan. 1975
Avail: NTIS HC $4.50

A survey is presented of hot-wire and hot-film anemometers for turbulent flow measurement, the dynamic response of the wire for the small overheat case is highlighted, as well as the constant temperature type of anemometer. A qualitative comparison is made between constant current and constant temperature anemometers. ESA

N76-11388# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

SPACE-TIME CORRELATIONS

G. Comte-Bellot (Ecole Centrale de Lyon) and J. Sabot (Ecole Centrale de Lyon) 1975 52 p refs Presented at the VKI Lecture Series 73 on Meas. of Unsteady Fluid Dyn. Phenomena, Rhode-Saint-Genese, Belg., 27-31 Jan. 1975
Avail: NTIS HC $4.50

The physical interpretation of the various correlations used in turbulence (space correlations, time correlations, space-time correlations) are indicated, and the experimental procedure is discussed. A gradual approach is made, according to the values of both the mean velocity and the mean velocity gradient with which the turbulence is associated. Homogeneous isotropic turbulence and its laboratory approach by means of grids placed in uniform flows an dealt with, and results for homogeneous anisotropic turbulence are given. Usual turbulent shear flows are discussed. Free edge vicinities are considered, along with the core region of flows in which the turbulent structures organized by mean velocity gradients possessing opposite signs meet. Only Eulerian correlations were considered. A few indications are given for Lagrangian correlations which always have a spacetime nature. Author (ESA)

N76-11389# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

EXPERIMENTAL STUDY OF HOT SPOTS IN ACTIVE PACKED BEDS

J. M. Buchlin and J. J. Ginoux Mar. 1975 29 p refs Sponsored in part by Centre d'Etude de l'Energie Nucl.
(VKI-TN-108) Avail: NTIS HC $4.00

A test facility developed to simulate hot spots in gas cooled thermal reactors using fuel packed beds is described. A series of typical results is discussed which confirm the good tuning of the test set-up and proves the existence of hot spots. Author (ESA)

N76-11390# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

THE DAMPING SURFACE TECHNIQUE FOR TIME-DEPENDENT SOLUTIONS TO FLUID DYNAMIC PROBLEMS

M. Couston, P. W. McDonald, and J. J. Smolderen Mar. 1975 37 p refs
(VKI-TN-109) Avail: NTIS HC $4.00

A new transient technique is presented for the stable, accurate, and efficient solution of complex fluid dynamic problems. This method (damping surface technique) is applied to pseudo-one directional flow in nozzles with strong shock waves. Comparisons of computational speed and accuracy are made between this technique and the Lax-Wendroff two step scheme. Physical and mathematical interpretations of the damping surface technique are discussed. Author (ESA)

N76-11391# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

THEORY OF TURBULENT OSCILLATIONS IN BOUNDARY LAYER FLOWS [ZUR THEORIE DER TURBULENTEN SCHWANKUNGEN IN GRENZSCHICHTSTROEMUNGEN]

H. Reichardt and R. Reuter Aug. 1974 38 p refs In GERMAN; ENGLISH summary
(Rept-7/1974) Avail: NTIS HC $4.00; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 10,95

Measurements of fluctuating velocities near a wall were made in an oil channel and the results contradicted earlier ideas on the viscous wall layer. A theory of the new effects could be established from nonsteady equations of motion. The theory was extended into that region where turbulent shear stress emerges due to the first appearance of transverse fluctuation. To develop this theory, use was made of experimental results describing in particular non-dimensional amplitude functions of both longitudinal and transverse fluctuations. ESA

N76-11392# European Space Agency, Paris (France).

INDUCTIVE TREATMENT OF PRANDTL'S 1945 EQUATIONS FOR FULLY DEVELOPED TURBULENCE

J. C. Rotta Sep. 1975 41 p refs Transl. into ENGLISH of "Induktive Behandlung des Prandtlschen Formelsystems fuer die ausgebildete Turbulenz von 1945", DFVLR, Goettingen, West Ger. Report DLR-FB-74-51, Jul. 1974 Original German report available from DFVLR, Porz, West Ger. 13.50 DM
(ESA-TT-188; DLR-FB-74-51) Avail: NTIS HC $4.00

Systematic investigations of the differential equations for calculation of turbulent shear flows, which are supplemented by a transport equation for the length scale are described. The aim was to examine the usefulness of the relationships, to study the influence of the particular terms, and to gain knowledge on the empirical coefficients appearing in the equations. Starting from known distributions of the mean velocities, the distribution of kinetic fluctuation energy and length scale were computed. The compatibility of the results with the transport equation for the length scale was examined and the relevant empirical coefficients determined. It was found that a single system of equations for calculation of pipe flow, plane free jet, plane wake, and free mixing layer can be developed on this basis. Author (ESA)

N76-11393# European Space Agency, Paris (France).
OPTICAL COMPENSATION MEASUREMENTS ON THE NONSTATIONARY EXIT CONDITION AT A NOZZLE DISCHARGE EDGE. AN INVESTIGATION IN CONNECTION WITH SOUND TRANSMISSION THROUGH NOZZLES WITH FLOW
Dietrich Bechert and Eberhard Pfizenmaier Sep. 1975 77 p refs Transl. into ENGLISH of "Opt. Kompensationsmessungen zur instationaeren Abflussbedingung an einer Duesenaustrittskante. Eine Untersuch. im Zusammenhang mit dem Schalldurchgang bei durchstroemten Duesen", DFVLR, Berlin Report DLR-FB-73-93, 30 Jul. 1973 Original German report available from DFVLR, Porz, West Ger. 27.70 DM
(ESA-TT-191; DLR-FB-73-93) Avail: NTIS HC $5.00

The exit conditions at the trailing edge of a nozzle with a slightly nonstationary flow were investigated experimentally. These conditions play a major role in the theory of sound transmission through such nozzles. The measurements were carried out for a range of the Reynolds number R (relative to the nozzle diameter) between 10,000 and 100,000 and for a range of Strouhal numbers so that, for R equal to 10,000, the entire spectrum of amplified waves in the boundary layer was included. The technique used was based on the synchronization of a small laser beam with the wave motion of a small smoke filament in the boundary layer leaving the nozzle. The measurements of the jet flow deflection had a resolution between one and three microns. No singularity in the velocity near the edge was found. The flow problem therefore remains linear for small oscillating velocities in that area. Author (ESA)

N76-11394# Boston Univ., Mass. Engineering Labs.
NUMERICAL SOLUTION OF THE FLOW FIELD ABOUT TWO-DIMENSIONAL SHAVED CIRCULAR CYLINDERS IN SUPERSONIC FLOW Scientific Interim Report
Jeng S. Huang Dec. 1974 83 p refs
(Contract F19628-71-C-0209; AF Proj. 7659)
(AD-A012293; SR-3; AFCRL-TR-74-0418) Avail: NTIS CSCL 20/4

A theoretical investigation of the flow of a perfect gas over two-dimensional shaved circular cylinders was conducted at supersonic Mach numbers for the purpose of obtaining shock wave shapes. An integral relation method was used for the numerical solution for the flow in the subsonic-transonic region. For the supersonic region, the method of characteristics was used to obtain a numerical solution. The computer programs of both methods were developed for calculating the properties of the flow field. The starting values for the characteristic method were obtained from the integral relation method. Numerical solutions were obtained for a perfect gas in thermodynamic equilibrium with ratio of specific heat, gamma = 1.4 over a Mach number range from 2 to 10. Results for the shock wave shape and stand-off distance are presented for all numerical solutions and comparison is made with experimental results. Author

N76-11395# Naval Ship Research and Development Center, Bethesda, Md.
A MODIFIED LAW OF THE WAKE FOR TURBULENT SHEAR FLOWS
Paul S. Granville May 1975 18 p refs
(AD-A012271; NSRDC-4639) Avail: NTIS CSCL 20/4

The analytical description of similarity-law velocity profiles for turbulent shear flow has been improved by a proposed polynomial which modifies the Coles law of the wake to satisfy the outer slope condition. GRA

N76-11396# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.
ON THE DEVELOPMENT OF A UNIFIED THEORY FOR VORTEX FLOW PHENOMENA FOR AERONAUTICAL APPLICATIONS Technical Report, 1 Nov. 1973 - 31 Oct. 1974
Thomas K. Matoi 14 Apr. 1975 145 p refs
(Contract N00014-67-A-0204-0085; NR Proj. 215-230)
(AD-A012399) Avail: NTIS CSCL 20/4

The low-speed performance of a high span loading aircraft depends critically on the structure and stability of the vortex flow field created by the wing. Conventional formulation of lifting surface theory is not adequate to handle the low-aspect-ratio wing problem since the leading edge vortices add several complications. Specifically, the nonplanar nature of the vortex sheet may have to be considered explicitly, the leading-edge loading is altered, and vortex breakdown is a rotational phenomenon. Due to those additional difficulties, a study was made of the state of the art in vortex-wing interactions. GRA

N76-11397# Naval Postgraduate School, Monterey, Calif.
HARMONIC MOTION OF CYLINDERS IN UNIFORM FLOW M.S. Thesis
James Thomas Fry Jun. 1975 54 p refs
(AD-A012412) Avail: NTIS CSCL 13/10

The time-dependent force acting on a cylinder undergoing harmonic in-line oscillations in an otherwise steady flow was measured for various amplitudes and frequencies of oscillation and mean flow velocity. The experiments were carried out in a recirculating water tunnel operating as an open channel with a free surface at the test section. The time-dependent force has been expressed in terms of a mean drag coefficient and the Fourier-averaged drag and inertia coefficients and as functions of the relative amplitude and a frequency parameter. GRA

N76-11398# Army Engineer Waterways Experiment Station, Livermore, Calif. Explosive Excavation Research Lab.
ONE-DIMENSIONAL ANALYSES: SHOCK WAVE PROPAGATION FROM UNDERWATER CRATERING DETONATIONS Final Report
Charles M. Snell Jan. 1975 567 p refs
(DA Proj. 2O0-61102-B-33G)
(AD-A012065; WES-MP-E-75-1) Avail: NTIS CSCL 19/4

Research has recently been conducted on the use of large buried chemical explosive charges for engineering excavation. Investigations in this area were initially concerned with crater formation in relatively homogeneous rock media, a process which is now well understood. However, it has become apparent that the greatest cost and operational advantages may be realized by applying the technique to rock excavation in an underwater environment. Cratering dynamics in an underwater (two-layer) configuration have not been well understood. Small-scale modeling tests and large-scale excavation projects have revealed two new factors which significantly influence underwater cratering processes: (1) early-time dynamic effects caused by the presence of the rock-water interface and water layer; and (2) very late-time water washback and slope failure effects in the crater vicinity. The report addresses the first of these two effects by means of hydrodynamic computer calculations. GRA

N76-11399# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN INTEGRAL ANALYSIS OF BOUNDARY LAYERS ON MOVING WALLS Final Report
Kevin S. Fansler and James E. Danberg Jun. 1975 119 p refs
(DA Proj. 1T1-61102-A-33D)
(AD-A012205; BRL-1792) Avail: NTIS CSCL 20/4

An integral method for calculating the nonsimilar steady two-dimensional boundary-layer development on both upstream and downstream moving walls has been developed. Separation from moving walls is briefly reviewed and a separation criterion for the technique is developed that conforms with some accepted ideas on boundary-layer separation. The integral-momentum and integral-energy boundary-layer equations have been integrated simultaneously by using the shape factor relationships derived from moving-wall similarity solutions. The results are found to compare favorably with an exact solution and an approximate solution. The stability of the boundary-layer development calculations is also examined. GRA

N76-11400# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
COMPRESSIBLE BOUNDARY LAYERS OVER WAVY WALLS
Spyridon G. Lekoudis, Ali H. Nayfeh, and William S. Saric May 1975 37 p refs
(Contract N00014-72-A-0136-002; NR Proj. 061-201)
(AD-A012004; VPI-E-75-9) Avail: NTIS CSCL 20/4

An analysis is presented of compressible viscous flows past

wavy walls, without restricting the mean flow to be linear in the disturbance layer. Linearization of the compressible disturbance equations results in a system of six first-order differential equations for the perturbation quantities. The method of orthonormalization is used to control the error growth in the numerical solution of these equations. The present results agree more closely with experimental data than the results obtained by using Lighthill's theory, which restricts the mean flow to be linear in the disturbance layer. GRA

N76-11401# Naval Civil Engineering Lab., Port Hueneme, Calif. Naval Construction Battalion Center.
NUCLEAR SHOCK WAVE PROPAGATION THROUGH AIR ENTRAINMENT SYSTEMS OF HARDENED FACILITIES Final Report, Nov. 1973 - May 1974
R. H. Fashbaugh, A. Widawsky, and D. Pal Apr. 1975 56 p refs
(AD-A011812; CEL-TR-820) Avail: NTIS CSCL 18/3

An analytical study was undertaken to develop the capability of predicting nuclear shock wave propagation through air entrainment systems of hardened facilities. All solutions presented in this report are one-dimensional. Two finite-difference schemes for approximately the hyperbolic partial differential equations of fluid dynamics are used: the pseudo-viscosity scheme in a variable area Lagrange formulation, and the Lax-Wendroff two-step scheme in an Eulerian formulation. Shock wave attenuation due to viscous losses at ducting walls is included. A comparison of the results of the analysis with shock tube experimental data shows both formulations to be adequate. GRA

N76-11402# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
AN EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER IN A ROTATING FLUIDIZED BED Final Report, Jan. 1972 - Oct. 1973
James M. Howard, II May 1975 110 p refs
(AF Proj. 7116)
(AD-A011982; ARL-75-0115) Avail: NTIS CSCL 21/6

An in depth study of the heat transfer characteristics of a rotating fluidized bed has been conducted and comparisons made with the results of a similar study of the heat transfer characteristics of a columnar bed. The heat transfer results for the rotating fluidized bed have been extrapolated to several previously described colloid core nuclear reactor designs to predict operating temperatures and particle-gas temperature differentials. It has been concluded that the rotating fluidized bed exhibits much better heat transfer than a columnar fluidized bed for similar flow conditions. Results for the rotating fluidized bed indicate that its operation may be varied so as to tailor its heat transfer characteristics to specific applications. Extrapolation to the colloid core nuclear reactor indicates operating temperatures around 3750K and particle-gas temperature differentials of less than 100K for a variety of operating conditions. GRA

N76-11006* Virginia Polytechnic Inst. and State Univ., Blacksburg.
ASYMPTOTIC ANALYTICAL METHODS IN FLUID MECHANICS RELATED TO DRAG PREDICTION
G. R. Inger *In* Kansas Univ. Proc. of the NASA, Ind., Univ., Gen. Aviation Drag Reduction Workshop 1975 p 117-124 refs (For availability see N76-10997 02-01)
CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-11403# Buechi (Ulrich P.) S.A., Zurich (Switzerland). Geologische Expertisen und Forschungen AG.
BASIC MATHEMATICS FOR EVALUATING BEVAMETER MEASUREMENTS [MATHEMATISCHE GRUNDLAGEN ZUR AUSWERTUNG DER BEVAMETERMESSUNGEN]
D. Itschner 30 Apr. 1974 42 p refs In GERMAN
(CH-3000; Ber-443) Avail: NTIS HC $4.00

The Bevameter contains a stamp printer and a ring shearing apparatus for measuring Bekker's soil parameters when considering terrain suitability for wheeled vehicles. Analytical functions are developed for modeling measurement curves according to rolling resistance and traction. Transl. by G.G.

N76-11404*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GUIDE TO THE USE OF MARINER IMAGES
R. S. Saunders, T. A. Mutch (Brown Univ.), and K. L. Jones 15 Oct. 1975 28 p refs
(Contract NAS7-100; Grant NGR-40-002-088)
(NASA-CR-145621; JPL-TM-33-723) Avail: NTIS HC $4.00 CSCL 14E

Planetary imaging from unmanned spacecraft, almost exclusively done by digital systems, is examined. The Mars Mariner 9 television camera, representative of such systems, is considered. Each image consists of 700 lines, each containing 832 picture elements, or pixels. Each pixel contains nine binary bits of information capable of displaying 512 discrete brightness levels. Several problems inherent in television systems are discussed. These include nonuniform target response, residual images, noise, and blemishes. These defects can be removed to some extent by decalibration of the image. The final product is geometrically corrected for camera distortion and photometrically corrected. Several versions of the decalibrated images are available. The most generally useful are the geometrically corrected images with enhanced contrast. The Mariner 10 imaging of Mercury is briefly discussed. Author

N76-11405*# Radiometric Technology, Inc., Wakefield, Mass.
APPLICATIONS OF MICROWAVES TO REMOTE SENSING OF TERRAIN Topical report, May - Oct. 1974
Ronald A. Porter Washington NASA Nov. 1975 58 p refs
(Contract NAS1-13126)
(NASA-CR-2581) Avail: NTIS HC $4.50 CSCL 14B

A survey and study was conducted to define the role that microwaves may play in the measurement of a variety of terrain-related parameters. The survey consisted of discussions with many users and researchers in the field of remote sensing. In addition, a survey questionnaire was prepared and replies were solicited from these and other users and researchers. The results of the survey, and associated bibliography, were studied and conclusions were drawn as to the usefulness of radiometric systems for remote sensing of terrain. Author

N76-11406*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
COMPUTER PROGRAM DESIGN SPECIFICATIONS FOR THE BALLOON-BORNE ULTRAVIOLET STELLAR SPECTROMETER (BUSS) SCIENCE DATA DECOMMUTATION PROGRAM (BAPS48)
R. M. Rodriguez Oct. 1975 21 p
(Contract NAS9-12200)
(NASA-CR-144552; LEC-6888; JSC-09941) Avail: NTIS HC $3.50 CSCL 14B

The Balloon-Borne Ultraviolet Stellar Spectrometer (BUSS) Science Data Documentation Program (BAPS48) is a pulse code modulation documentation program that will format the BUSS science data contained on a one inch PCM tracking tape into a seven track serial bit stream formatted digital tape. Author

N76-11407*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DEVELOPMENT AND CHARACTERISTICS OF THE HARDWARE FOR SKYLAB EXPERIMENT S015
Robert G. Thirolf Sep. 1975 44 p ref
(NASA-TM-X-58164; JSC-09728) Avail: NTIS HC $4.00 CSCL 14B

Details are given regarding the hardware for the Skylab S015 experiment, which was designed to detect the effects of zero gravity on cell growth rates. Experience gained in hardware-related considerations is presented for use of researchers concerned with future research of this type and further study of

the S015 results. Brief descriptions are given of the experiment hardware, the hardware configuration for the critical design review, the major configuration changes, the final configuration, and the postflight review and analysis. An appendix describes pertinent documentation, film, and hardware that are available to qualified researchers; sources for additional or special information are given. Author

N76-11408# Instituto de Investigaciones Cientificas y Tecnicas de las Fuerzas Armadas (CITEFA), Buenos Aires (Argentina).
FUNDAMENTALS OF SPECKLE'S TECHNIQUES AND THEIR RELATION WITH HOLOGRAPHIC METHODS
German DaCosta, Raul Jiminez Rebagliati, and Jorge E. A. Toni Jul. 1975 56 p refs In SPANISH; ENGLISH summary
Avail: NTIS HC $4.50

The general properties of speckles and their superposition and interference are described. Some applications to the study of mechanical deformations (translation and rotation) are included along with some experimental results. The fundamentals and the holographic methodology with lasers, which are speckle emissors (highly excited ruby laser) and which are of interest in pulse holography are discussed. Nonlinear optics and Raman effect are considered. Author

N76-11409# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
DISPLAY SYSTEMS ACCORDING TO THE TELEVISION GRATING METHOD, NOTING GRAPHICAL REPRESENTATION Ph.D. Thesis - Tech. Univ. Berlin [DISPLAY-SYSTEME NACH DEM FERNSEHRASTERVERFAHREN UNTER BESONDERER BERUECKSICHTIGUNG GRAPHISCHER DARSTELLUNGEN]
Gerald Troeller 1974 123 p refs In GERMAN
(TB-177) Avail: NTIS HC $5.50

The generation of graphical representations based on vectors and using a grating method was investigated for television receivers. The basic background for the selection of the television grating deflection is the fact that two information systems can be combined: analog and digital. By keeping to television standards, video images and digitally produced graphical or alphanumeric information can be combined on the screen. Colored displays present no problem if one replaces the black-and-white receiver by a color television set. ESA

N76-11410# European Space Agency, Paris (France).
AN AIRBORNE 90 GHz RADIOMETRY RECEIVER
Bernhard Aumiller May 1975 74 p refs Transl. into ENGLISH of "Ein flugtauglicher 90-GHz-Radiometerempfaenger", DFVLR, Oberpfaffenhofen, West Ger. Report DLR-Mitt-74-05, 1974 Original German report available from DFVLR, Porz, West Ger. 27.80 DM
(ESA-TT-163; DLR-Mitt-74-05) Avail: NTIS HC $4.50

Development, construction, and performance tests of an airborne 90 GHz radiometry receiver for thermal millimeterwave radiation measurement are described. A modified Dicke principle having 2 reference noise sources is used in the receiver, thus ensuring reproducible absolute calibration. The design of the circuit is dealt with, excluding the theory of the thermal millimeterwave radiation and antenna problems. A description of the individual units is intended to explain their mode of operation and to make signal tracing possible. Operation of the radiometer and quantitative analysis of measurement results are explained. Author (ESA)

N76-11411# Block Engineering, Inc., Cambridge, Mass.
PHOENIX INTERFEROMETER Final Technical Report, Dec. 1973 - Jan. 1975
Paul G. J. Morse Jun. 1975 76 p
(Contract F33615-74-C-1074; ARPA Order 2116; AF Proj. 7660)
(AD-A011693; AFAL-TR-75-94) Avail: NTIS CSCL 14/2

The primary objective of the program was to provide a short wavelength spectroscopic capability to the Firebird system. The extension to shorter wavelengths permits acquisition of high resolution data in the important 2.7 and 4.2 micrometer regions. This information is considered essential for the development of plume radiation models and the unambiguous identification of specific excitation mechanisms in the SWIR spectral region. The spectrometer to be built for this program was to use a rapid scanning, high spectral resolution Michelson interferometer operating at high altitude ambient temperatures, around 220K. The sensor was to have a spectral range of 2 - 5.5 micrometers and a field of view of 5.6 milliradians which could be pointed at or held on airborne targets by means of the Firebird stabilized tracking system. The interferometer spectrometer was designed, developed, and fabricated. GRA

N76-11412# Naval Training Equipment Center, Orlando, Fla.
HOLOGRAPHIC HEADS-UP DISPLAY FOR NAVAL AVIATION TRAINING Final Report, Jul. 1972 - Dec. 1974
Alfred H. Rodeman, Denis R. Breglia, and Windell N. Mohon May 1975 164 p refs
(AD-A011819; NAVTRAEQUIPC-IH-229) Avail: NTIS CSCL 05/9

This report summarizes the results of an effort to apply the technology of high efficiency holographic lens design and fabrication to the specific case of a heads-up display system for use in visual simulators for aviation training. Design methods are developed. Materials research is described. Holographic lens elements are evaluated. GRA

N76-11413# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
FLUIDIC GYRO TORQUER
Aubrey Rodgers and Rayburn K. Widner 22 Apr. 1975 26 p refs
(DA Proj. 1W6-62603-AH-78)
(AD-A012072; RG-75-44) Avail: NTIS CSCL 17/7

The objective of this program is to develop fluidic torquer technology for missile guidance and control seeker type gyros. This report presents the technology in the development of a proportional/digital fluidic torquer and the associated electro-fluid converter. The conceptual design feasibility and hardware performance characteristics are confirmed by the evaluation material. The cost-effectiveness of the torquer design is established by the use of off-the-shelf items and design simplicity. High-g survival and reliability requirements of the converter are verified by a 10,000-g cannon launch test environment. The study of the concept indicates that implementation of fluidic gyro torquing is feasible. GRA

N76-11414# Naval Ammunition Depot, Crane, Ind.
FEASIBILITY STUDY OF PORTABLE CALIBRATION INSTRUMENTATION FOR AUDIO DOSIMETERS Final Report
David Montgomery 13 Dec. 1974 69 p refs
(Contract DI-BM-so-144091)
(PB-242577/5; NAD-CR-RDTR-289; BM-OFR-41-75) Avail: NTIS HC $4.50 CSCL 06J

The feasibility of building a calibrator for the DuPont D-100 audio dosimeter is discussed. The desired specifications are used as guidelines but the possibility of their relaxation is also considered. Commercially available equipment is surveyed and found to not satisfy the guidelines. Several alternate concepts are investigated, and recommendations for further work are presented. GRA

N76-11415 Pratt and Whitney Aircraft, East Hartford, Conn.
X-RAY WEAR METAL MONITOR Final Report, 1 May - 1 Nov. 1974
John R. Miner and Leonard L. Packer Jan. 1975 31 p
(Contract F33615-74-C-2024; AF Proj. 3048)
(AD-A011721; PWA-5224; AFAPL-TR-75-6) Avail: NTIS CSCL 14/2

The feasibility of using a X-ray fluorescence wear metal monitor to continuously monitor iron concentration levels in the lubrication system of an operating gas turbine engine was demonstrated. The X-ray wear metal monitor maintained oil seal integrity under the temperature and pressure environment of both laboratory simulated and actual engine operating conditions. The monitor also demonstrated the ability to make significant measurements of the iron concentration level in flowing MIL-L-7808 oil, under both laboratory and engine conditions, within a standard deviation of plus or minus three parts per million. This sensitivity is consistent with experience from the Spectrometric Oil Analysis Program. GRA

N76-11416# Minnesota Mining and Mfg. Co., St. Paul.
DRY SILVER CAMERA FILM, AERIAL EXPOSURE INDEX EQUALS 5 Final Report, Jul. 1973 - Nov. 1974
Robert Russell et al Mar. 1975 70 p
(Contract F33615-73-C-1273; AF Proj. 2004)
(AD-A011704; AFAL-TR-75-11) Avail: NTIS CSCL 14/5

This report describes achievements of a special film coating and testing program for panchromatic sensitive photographic film for direct optical recording from 350 through 750 nanometers wavelength. A new panchromatic sensitive recording film is described which has suitable sensitivity for photorecording at aerial exposure index values from 3 to 5. This film is unique in that the exposed latent images may be converted to visible metallic silver image form using only thermal processing instead of wet chemical processing normally required for silver halide type recording films. The report also describes the results from limited aerial photographic flight testing of this new film in an RF-101 Tactical Reconnaissance Aircraft in a standard Air Force KS-87 aerial camera. Printed replicas are included in this report of photographic results obtained from camera exposures. GRA

N76-11417# Utah State Univ., Logan. Space Science Lab.
DESIGN AND CALIBRATION OF A ROCKET-BORNE ELECTRON SPECTROMETER
Parris C. Neal Dec. 1974 70 p refs
(Contract F19628-74-C-0130)
(AD-A011931; HAES-8; AFCRL-TR-74-0629; SR-1) Avail: NTIS CSCL 14/2

An electron spectrometer was designed, calibrated and used in an auroral research program to measure the electron energy spectra from 100 to 1500 eV. The approach included the practical application of theoretical mathematics to design and calibrate the instrument. Such design and calibration using a digital computer for fast analysis can be used in the design and testing of similar instruments. GRA

N76-11418*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
A HIGH-PRECISION CdS PHOTODETECTOR FOR SUN SENSOR APPLICATIONS
F. R. Chamberlain 15 Oct. 1975 13 p
(Contract NAS7-100)
(NASA-CR-145553; JPL-TM-33-742) Avail: NTIS HC $3.50 CSCL 14B

A sun detector developed for the Mariner Jupiter/Saturn mission is described. Redundant photopotentiometers for both pitch and yaw axes, positioned below slit apertures, provide spacecraft stabilization and biased operation over plus or minus 20-deg fields of view. The biased (off-sun) operation is required for pointing the 366-cm-diameter (spacecraft-fixed) radio antenna toward earth. Configuration and fabrication processes are presented, along with a summary of development history. Particular attention is given to the properties of cadmium sulfide as these affect adaptation to this application. Author

N76-11419# Denver Univ., Colo. Dept. of Physics and Astronomy.
CONSTRUCTION OF A BALLOON BORNE RF QUADRUPOLE MASS SPECTROMETER PACKAGE Final Report, 7 Dec. 1972 - 31 Aug. 1974
David G. Murcray and Robert C. Amme Jun. 1975 65 p refs
(Contract DAAD05-73-C-0139; DA Proj. 1T1-61102-B-53A)
(AD-A011313; BRL-CR-235) Avail: NTIS CSCL 14/2

A balloon-borne, radio-frequency mass spectrometer was constructed under this contract. The package is designed to study the ambient positive ion and more abundant neutral molecules of the upper stratosphere. The range of the mass spectrometer is 1 to 150 amu, with a resolution which can be set to better than 1 amu over that range. Titanium sublimation is used to pump the bulk of the gas load, with assistance from a liquid helium CO2 frost pump. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-11420*# Illinois Univ., Urbana. Gaseous Electronics Lab.
STUDIES OF DISCHARGE MECHANISMS IN HIGH PRESSURE GASES-APPLICATIONS TO HIGH EFFICIENCY HIGH POWER LASERS Ph.D. Thesis. Semiannual Progress Report
B. E. Cherrington, J. I. Verdeyen, J. G. Eden, and S. Leslie
1 Nov. 1975 74 p refs
(Grant NGR-14-005-200)
(NASA-CR-145643) Avail: NTIS HC $4.50 CSCL 20E

By measuring the absorption and emission cantinua of various states in the cesium/xenon molecule, the collisional rates critical in populating the alkali/rare gas excimer levels have been estimated. Cs atomic states that are weakly optically connected to ground have been shown to form excimer levels that are attractive as potential dissociation lasers. In particular, the (Cs/7 2S/Xe) excited molecule appears promising as a source of high energy laser radiation due to its large dissociation energy, stimulated emission cross section, and small population inversion densities. Monitoring of the optically pumped Cs2 molecular absorption profile in the presence of xenon shows a drastic change with increasing xenon pressure for the Cs2C band. Dominant absorption at large xenon densities is centered around approximately 6380 A as opposed to 6300 A for lower perturber pressure. Author

N76-11421*# Itek Corp., Lexington, Mass.
FEASIBILITY OF A 30-METER SPACE BASED LASER TRANSMITTER Final Report
R. R. Berggren and G. E. Lenertz Oct. 1975 111 p refs
(Contract NAS3-19400)
(NASA-CR-134903; Rept-8254-1) Avail: NTIS HC $5.50 CSCL 20E

A study was made of the application of large expandable mirror structures in future space missions to establish the feasibility and define the potential of high power laser systems for such applications as propulsion and power transmission. Application of these concepts requires a 30-meter diameter, diffraction limited mirror for transmission of the laser energy. Three concepts for the transmitter are presented. These concepts include consideration of continuous as well as segmented mirror surfaces and the major stow-deployment categories of inflatable, variable geometry and assembled-in-space structures. The mirror surface for each concept would be actively monitored and controlled to maintain diffraction limited performance at 10.6 microns during operation. The proposed mirror configurations are based on existing aerospace state-of-the-art technology. The assembled-in-space concept appears to be the most feasible, at this time. Author

N76-11422*# Stanford Univ., Calif. High Temperature Gasdynamics Lab.
SUPERSONIC CO ELECTRIC-DISCHARGE LASERS Semiannual Progress Report, 1 May - 31 Oct. 1975
R. K. Hason, M. Mitchner, and Alan Stanton 31 Oct. 1975 28 p refs
(Grant NsG-2050)
(NASA-CR-145688) Avail: NTIS HC $4.00 CSCL 20E

Laser modeling activity is described which involved addition of an option allowing N2 as a second diatomic gas. This option is now operational and a few test cases involving N2/CO mixtures were run. Results from these initial test cases are summarized. In the laboratory, a CW double-discharge test facility was constructed and tested. Features include: water-cooled removable electrodes, O-ring construction to facilitate cleaning and design modifications, increased discharge length, and addition of a post-discharge observation section. Preliminary tests with this facility using N2 yielded higher power loadings than obtained in the first-generation facility. Another test-section modification, recently made and as yet untested, will permit injection of secondary gases into the cathode boundary layer. The objective will be to vary and enhance the UV emission spectrum from the auxiliary discharge, thereby influencing the level of photoionization in the main discharge region. Author

N76-11423# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
LASER FREQUENCY BROADENING BY ATMOSPHERIC TURBULENCE

Charles P. Wang 1 Nov. 1975 24 p refs
(ATR-76(8204)-1) Avail: NTIS HC $3.50

The temporal coherence degradation or frequency broadening of laser irradiance propagating through atmospheric turbulence was studied. The laser power spectral density is expressed in terms of various turbulent parameters. The full width at half maximum of the laser power spectral density after propagating through a turbulent medium was derived for two limiting cases. Typical results for 10 m/sec wind velocity are 2,300 rad/sec for vertical propagation and 45,000 rad/sec for horizontal propagation of 10 km. It is concluded that this broadening is important for coherent radar ranges larger than 10 km. Author

N76-11424*# Owens-Illinois, Inc., Toledo, Ohio.
DEVELOPMENT OF IMPROVED AMORPHOUS MATERIALS FOR LASER SYSTEMS Final Report
George F. Neilson and Michael C. Weinberg 27 Nov. 1974 78 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953846)
(NASA-CR-145616; R74-120) Avail: NTIS HC $5.00 CSCL 20E

Crystallization calculations were performed in order to determine the possibility of forming a particular type of laser glass with the avoidance of devitrification in an outer space laboratory. It was demonstrated that under the homogenuous nucleating conditions obtainable in a zero gravity laboratory this laser glass may be easily quenched to a virtually crystal-free product. Experimental evidence is provided that use of this material as a host in a neodymium glass laser would result in more than a 10 percent increase in efficiency when compared to laser glass rods of a similar composition currently commercially available. Differential thermal analysis, thermal gradient oven, X-ray diffraction, and liquidus determination experiments were carried out to determine the basics of the crystallization behavior of the glass, and small-angle X-ray scattering and splat-cooling experiments were performed in order to provide additional evidence for the feasibility of producing this laser glass material, crystal free, in an outer space environment. Author

N76-11425# California Univ., Livermore. Lawrence Livermore Lab.
RAY TRACE LASER SOURCES IN LASNEX
D. S. Bailey 28 Oct. 1974 16 p Presented at 16th Ann. Meeting of the Div. of Plasma Phys. of the Am. Phys. Soc., Albuquerque, New Mexico, 28-31 Oct. 1974 Sponsored by ERDA
(UCRL-75881; Conf-741079-6) Avail: NTIS HC $4.00

In order to treat real laser sources propagating in real target plasmas without solving Maxwell's equations, a geometric optics approximation was used to obtain the energy flow and deposition. The scheme used and two examples are described. The first is a slab of CH2 illuminated with a 2 nsec, 10 J 40 mu radius spot of a CO2 laser of uniform intensity profile up to the sharp drop at the spot radius. The second example was designed to see the effect of illumination on a low compression (approximately 10) experiment. NSA

N76-11426# Addis Translations International, Woodside, Calif.
CALCULATIONS OF LASER-EMISSION PARAMETERS IN MOLECULAR NITROGEN
J. P. Girardeau-Montaut and C. Girardeau-Montaut [1974] 39 p refs Transl. into ENGLISH from Nouv. Rev. Opt. (France), v. 5, no. 3, 1974 p 179-183 Sponsored by ERDA
(UCRL-Trans-10832) Avail: NTIS HC $5.00

The purpose of the calculations carried out was to determine the variation of the main emission parameters of an ultraviolet molecular-gas laser with pulsed electronic pumping. In particular, they make it possible to analyze the time variations of the electron energy and density in the gas, the resistance of the plasma created during the pumping, the population inversion rate and the laser power density for given operating conditions (applied electric field and gas pressure). These calculations, worked out for the case of the transitions from the 2nd positive band, can easily be extended to other molecular gases having analogous population-inversion schemes. They can be used to evaluate the probability of new short-wavelength laser emissions and the optimal operating conditions. Author (NSA)

N76-11427# California Univ., Livermore. Lawrence Livermore Lab.
LASER FUSION: CAPITAL COST OF INERTIAL CONFINEMENT
R. E. Kidder 11 Feb. 1975 5 p refs Presented at Intern. Conf. on Energy Storage, Compression and Switching, Turin, Italy, 5 Nov. 1974 Sponsored by ERDA
(UCRL-76546; Conf-741113-10) Avail: NTIS HC $4.00

In the context of laser-induced fusion of solid pellets, a quadratic relation between peak laser power and the inertial confinement parameter rhoR is derived and discussed. This relation is combined with the linear relation between laser system cost and peak output power to obtain an estimate of the capital cost of inertial confinement. Author (NSA)

N76-11428# Avco-Everett Research Lab., Everett, Mass.
INVESTIGATIONS INTO THE FEASIBILITY OF HIGH POWER LASER WINDOW MATERIALS Semiannual Technical Report
Jacob L. Zar 15 Apr. 1975 36 p refs
(Contract F19628-75-C-0066; DARPA Order 2806)
(AD-A012290; AFCRL-TR-75-0264; SATR-1) Avail: NTIS CSCL 20/5

A test facility is being constructed for testing laser window material. This will use the focused beam from a 15 kW CW laser at 10.6 micrometers or other available lasers. Provision for cooling the window is included and also instrumentation for measuring optical and mechanical effects. Forty-seven natural diamonds have been tested to find the correlation between the UV absorption spectrum, the IR absorption spectrum and the absorption coefficient beta at 10.6 micrometets. Transparency at .253 micrometer is roughly correlated with low values of beta. A water cooled diamond window holder is described. A specimen of single crystal CaF2 and another of pressure induced recrystalized CaF2 were exposed to a 20 joule, 5 microsec 6.7 x 10 to the 7th power watt/sq cm pulse of 2.8 micrometer laser radiation with no apparent damage. GRA

N76-11429# Raytheon Co., Waltham, Mass. Research Div.
ADVANCED TECHNIQUES FOR IMPROVING LASER OPTICAL SURFACES Final Report, 1 Jul. 1973 - 28 Feb. 1975
Charles B. Willingham, Richard H. Cosgro, Dominic P. Bua, and Morey R. Schapira Mar. 1975 152 p refs
(Contract F19628-73-C-0280; ARPA Order 2415)
(AD-A012289; S-1856; AFCRL-TR-75-0225) Avail: NTIS CSCL 20/6

Chemical and chemical-mechanical polishing, ion-beam polishing, bowl-feed and continuously recycled abrasive :super-polishing: techniques were evaluated for single crystal and polycrystalline potassium chloride and calcium fluoride, and polycrystalline zinc selenide. Optimized conventional grinding and polishing techniques were established for calcium fluoride and zinc selenide. Diamond abrasive polishing, using conventional techniques, was shown to produce superpolished surfaces conveniently and reliably on these materials. Optimized chemical polishing techniques were selected for potassium chloride and zinc selenide, and a potentially useful chemical polish for calcium fluoride was identified. Ion beam polishing was shown to be potentially useful only as a final surface cleaning step, preparatory to antireflection coating deposition. GRA

N76-11430# Army Electronics Command, Fort Monmouth, N.J.
ABSORPTION OF DF LASER RADIATION BY PROPANE AND BUTANE
Kenneth O. White and Wendell R. Watkins Jun. 1975 20 p refs
(DA Proj. 1T6-62609-A-308)
(AD-A012169; ECOM-5563) Avail: NTIS CSCL 07/3

Strong absorption bands exist in propane, n-butane, and isobutane in the 3.8 micrometer DF (deuterium flouride) laser spectral output region. Spectral scans of pure atmospheres of these gases were made using a spectrophotometer to obtain moderate resolution data. Long-path absorption cell measurements were made using five DF laser output wavelengths to obtain high resolution data for the three gases. The absorption cell concentrations of the gases used, 150 to 450 mtorr, were buffered to 760 torr with nitrogen. Results show that DF radiation

is attenuated by a few percent per km when propane or butane concentrations are a few ppm. GRA

N76-11431# Hughes Research Labs., Malibu, Calif.
COAT MEASUREMENTS AND ANALYSIS
James E. Pearson May 1975 46 p refs
(Contract F30602-75-C-0001; ARPA Order 1279)
(AD-A011707; RADC-TR-75-101) Avail: NTIS CSCL 20/6

Compensation for thermal blooming distortions has been studied using multidither coherent optical adaptive techniques (COAT) in scaled laboratory experiments. An 18 element, visible wavelength, COAT systems was able to effect only a small improvement in peak target irradiance for forced-convection blooming. Similar results were observed with a truncated Gaussian beam using a computer simulation which models atmospheric thermal blooming and uses a phase conjugate COAT control algorithm to adjust the transmitted beam phase. Refinements in the experimental apparatus to eliminate buoyancy effects are discussed and a design is presented for incorporating adaptive pointing and focus controls into the COAT system. Two designs for an artificial turbulence generator are presented along with a design for adding adaptive tracking and focus controls to the RADC/COAT system. Preliminary COAT studies without turbulence or blooming but with complex moving targets are reported. Normal COAT system operation is observed with all targets if the receiver has sufficient resolution and if the system signal-to-noise ratio is large enough for stable operation. GRA

N76-11432# Grumman Aerospace Corp., Bethpage, N.Y.
HIGH AVERAGE POWER DIODE LASER ILLUMINATOR Final Report, May 1973 - Oct. 1974
James T. Fulton and Irwin Kaplan May 1975 114 p
(Contract F33615-73-C-1045)
(AD-A011692; AFAL-TR-74-162) Avail: NTIS CSCL 20/6

This program was to develop a high power cooled Gallium Arsenide laser system of 1/2 degree x 1/2 degree field of view without encountering the severe heating problem associated with the fiber optic approach. Through the use of a crossed cylindrical optical system and a spray type cooling assembly, the 30 watt power objective was achieved. A growth potential to about 50 watts is indicated without significant modifications. 100 watts appears feasible with modifications. By limiting the initial cooldown rate, it appears that a significant increase in system operating life is achieved. GRA

N76-11433# EOCOM Corp., Irvine, Calif.
LASER WAVEFRONT PROFILING TECHNIQUES FOR PULSED RADIATION Final Report, 2 Jun. 1972 - 3 Jan. 1975
R. E. Gillespie , R. V. Wick (AF Weapons Lab., Kirtland AFB, N. Mex.), and A. C. Saxman (AF Weapons Lab., Kirtland AFB, N. Mex.) Jun. 1975 144 p refs
(Contract F29650-72-C-0736; ILIR Proj. 72-09)
(AD-A011944; AFWL-TR-74-305) Avail: NTIS CSCL 20/5

The rapidly advancing field of high power laser technology has created the requirement for new advanced diagnostic systems. Many approaches have been used in the past to obtain pulsed laser wavefront profiles, all of which are very time consuming and laborious techniques. A critical review was made of the existing approaches and new technologies and techniques were analyzed for application to the measurement problem. The resulting system used a Hartmann plate sampling approach, along with transfer optics and a silicon-vidicon camera for accomplishing the laser radiation measurement, high-speed signal conditioning electronics and a high-speed digital computer/plotter system were used for data acquisition, processing and display. With this system a pulsed laser wavefront can be measured to the required accuracies on a timely basis. GRA

N76-11434# Hughes Research Labs., Malibu, Calif.
EXCIMER LASERS Semiannual Technical Report, 1 Oct. 1974 - 31 Mar. 1975
A. J. Palmer Jun. 1975 42 p refs
(Contract N00014-75-C-0081; DARPA Order 1807)
(AD-A011925) Avail: NTIS CSCL 20/5

The general goals of this program are to identify the required operating conditions for achieving practical net laser gain for an alkali-rare gas laser transition for optical pumping, avalanche discharge pumping and ultraviolet-sustainer discharge pumping, and to demonstrate net laser gain in the laboratory with one of the three pumping techniques. A versatile computer code which contains all relevant gas-kinetic processes, optical pumping processes, and electronic plasma processes has been developed and computes small-signal gain and absorption coefficients versus wavelength due to both alkali-rare gas molecules and alkali dimer molecules. The code is currently operational and is being used at present to guide the discharge and optical pumping experimental studies of the potassium-xenon system. Optical absorption measurements on the K-Xe system have been carried out clearly showing the contribution from both ground state K-Xe molecules and K2 molecules, with a wavelength profile in agreement with that predicted by the model. Fluorescence measurements on the discharge experiment have also been carried out showing both the excimer and dimer states in emission. Attempts are being made to both measure the gain directly using a GaAs probe laser and to achieve laser oscillation on the flashlamp-pumped K-Xe system. GRA

N76-11435# Rocketdyne, Canoga Park, Calif.
ADVANCED CHEMICAL LASER NOZZLE CONCEPTS Final Report, Apr. 1973 - Jun. 1974
J. C. Hyde and S. C. Hurlock Jun. 1975 189 p refs
(Contract F29601-73-A-0034-0001)
(AD-A011943; AFWL-TR-74-123) Avail: NTIS CSCL 20/5

The purpose of this program was to investigate experimentally the performance characteristics of high-pressure recovery, high-performance, advanced nozzle concepts for supersonic chemical lasers. Tests were conducted at small-scale (1 by 3 inches) sizes using scanning mirrors and a high-spatial-resolution IR spectrometer to examine performance. A small water-cooled pitot probe was used to scan the flowfield at the cavity exit to measure potential pressure recovery. A large-scale version of one of the nozzle configurations was designed and fabricated during this program and tested at the Mesa facility by the Aerospace Corporation. The Mesa results provided size scaling data for projecting Laser Engineering Test Facilities (LETF) results to larger sizes. Screening tests were performed on an advanced nozzle concept which provides increased mixing rates, larger throat dimensions, and decreased fabrication time and cost. The results of the screening tests indicated that the nozzles performed as predicted. GRA

N76-11436# Forest Products Lab., Madison, Wis.
CUTTING WOOD MATERIALS BY LASER
C. C. Peters and H. L. Marshall (GTE Sylvania, Inc.) 1975 13 p refs
(AD-A012226; FSRP-FPL-250) Avail: NTIS CSCL 11/12

Laser technology is undergoing unbelievably rapid expansion. To evaluate the ability of the laser for cutting wood and wood products, a 250-watt industrial type continuous carbon dioxide laser was used. The wood materials included green and dry lumber, plywood, and particleboard. The cutting phenomena changed from a zone of clean instantaneous vaporization for the first 1/16-inch of depth to a charring condition for the balance of the thickness cut. GRA

N76-11437# United Aircraft Corp., East Hartford, Conn. Research Labs.
ENERGY TRANSFER IN GAS LASER MATERIALS Final Report
Daniel J. Seery 1975 73 p refs
(Contract F44620-69-C-0100)
(AD-A011734; AFOSR-75-0675TR) Avail: NTIS CSCL 07/4

The major efforts in this program have been directed toward an understanding of vibration-vibration and vibration-translation energy transfer for collision partners of interest to high-powered infrared lasers. These studies have all been carried out using the shock tube - infrared emission technique. Reprints and preprints are included: On a shock-tube study of CO2-CO vibrational energy transfer; Intramolecular energy transfer in CO2; Vibrational relaxation of HCl with inert gas collision partner; Vibrational energy transfer in HCl-CO mixtures; and Chemistry of pollutant formation in flames. GRA

N76-11438# Systems Research Labs., Inc., Dayton, Ohio.
SERVO STABILIZATION OF TWO CO2 LASERS 10.7 MHz

APART Final Report, Jan. - Oct. 1974
William E. Boney, III and Joseph G. Brandelik AFAL May 1975 46 p refs
(Contract F33615-73-C-1069; AF Proj. 2001)
(AD-A011998; AFAL-TR-74-338) Avail: NTIS CSCL 20/6

Two carbon dioxide lasers were stabilized relative to each other by negative feedback, when the two optical cavities were mounted in a common mechanical cavity. With negative feedback, the lasers maintained a relative frequency stability one order of magnitude better than the no feedback, free-running, condition. The feedback system consisted of a HgCdTe detector operating in the photovoltaic mode to provide the beat frequency signal of the two lasers; it included also an inexpensive IC discriminator circuit operating at the FM intermediate frequency of 10.7 MHz, and the appropriate amplification to drive the piezoelectric length control of one laser, and thus modify the absolute frequency of that laser. When the absolute frequencies of the lasers were inverted relative to the negative feedback situation, the feedback system produced positive feedback. With positive feedback, the lasers maintained a frequency stability, relative to each other, of one order of magnitude worse than the no feedback, free-running condition. GRA

N76-11307 Western Ontario Univ., London. Dept. of Physics.
PROPERTIES OF ELECTROMAGNETIC RADIATION
J. Wm. McGowan *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 9 p refs (For availability see N76-11306 02-31)

N76-11308 Western Ontario Univ., London. Dept. of Physics.
LASERS
J. Wm. McGowan *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 12 p refs (For availability see N76-11306 02-31)

N76-11309 Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md. Laser Microwave Div.
INSTRUMENTATION AND MEASUREMENT OF LASER RADIATION
David H. Sliney *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 9 p refs (For availability see N76-11306 02-31)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-11439*# Joint Publications Research Service, Arlington, Va.
EFFECT OF ANOMALOUSLY LOW FRICTION
Ye. A. Dukhovskoy, A. N. Ponomarev, A. A. Silin, and V. L. Talroze Washington NASA Oct. 1975 14 p Transl. into ENGLISH from Priroda (Moscow), no. 8, Aug. 1975 p 88-93
(NASA-TT-F-16586) Avail: NTIS HC $3.50 CSCL 11H

The effect of anomalously low friction using several different materials is discussed and graphically illustrated. The physics of the phenomenon are described, and the results of the investigations are discussed as they involve use of electron microscopy, electron diffraction observations and mass-spectrometric investigations. The prospects of future investigations of this phenomenon are mentioned. Author

N76-11440# Technische Hochschule, Vienna (Austria).
ACTUAL DESIGN CRITERIA IN MECHANICAL ENGINEERING
Franz Mueller-Magyari and Walter Sperr 1975 7 p refs In GERMAN; ENGLISH summary
(ICAF-Doc-794) Avail: NTIS HC $3.50

Some methods by which the determination of the fatigue life of aircraft components can be performed were discussed. Two of these, the Safe Life and the Fail Safe approaches are the basis for numerous studies in fatigue analysis and fracture mechanics. In this case the crack length in a component is introduced as a measure of damage and the crack propagation rate as a criterion for the fatigue life. The objectives are an analysis of the local stress distribution in the cracked area and the question of damage accumulation. The empirical (program tests) and the analytical evaluation of damage accumulation (accumulation hypothesis) were discussed. The basis of such studies are evaluations of load-time histories and the correlation of load input and dynamic response data. A very recent item of engineering design, the transition from allowable-stress design to fatigue life prediction criteria, was also discussed. Author

N76-11441*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPRING OPERATED ACCELERATOR AND CONSTANT FORCE SPRING MECHANISM THEREFOR Patent Application
George L. Shillinger, Jr., inventor (to NASA) Filed 24 Oct. 1975 30 p
(NASA-Case-ARC-10898-1; US-Patent-Appl-SN-625732) Avail: NTIS HC $4.00 CSCL 13I

A spring assembly is described which consists of an elongate piece of flat spring material formed into a spiral and a free running spool. The spring has a distal end that is externally accessible so that when it is drawn along a path, the spring unwinds against a restoring force present in the portion of the spring between the relatively straight condition on the path and a fully wound condition on the spool. When the distal end is released, it is accelerated toward the spool by the force existing at the transition region. In one case, an accelerator may have a carriage for a test load and a pair of the spring assemblies installed to bias the carriage toward the center of a linear path. To cause the carriage to oscillate in a pattern of constant accelerations, the carriage is displaced to a position toward one end of the path and released, whereupon the springs cause the carriage and the load to be accelerated in reciprocation on the path. NASA

N76-11442# Oak Ridge Y-12 Plant, Tenn.
ULTRASONIC INSPECTION FOR LACK OF PENETRATION AND POROSITY IN A TUNGSTEN INERT GAS WELD WITH A STEP GEOMETRY
M. W. Moyer 21 May 1975 24 p refs Sponsored by ERDA (Y-1983) Avail: NTIS HC $4.00

Ultrasonic techniques were used to certify the penetration and porosity in three structural welds in Type AM 363 stainless steel. A normal beam technique detects a lack of penetration after the root-fusion weld pass. Shear-wave, angled-beam immersion techniques are used after the filler pass to detect any lack of penetration that is as large as 0.5 mm and porosity ranging in size from 0.5 to 1.3 mm. Author (NSA)

N76-11443# Power Reactor and Nuclear Fuel Development Corp., Oarai (Japan). Oarai Engineering Center.
SELF-WELDING BEHAVIOR OF VARIOUS MATERIALS IN SODIUM ENVIRONMENTS. 2: SELF-WELDING OF HARD METALS AND CARBIDE MATERIALS
S. Mizobuchi, S. Kano, M. Namekawa, T. Owada, and H. Atsumo 28 Oct. 1975 47 p refs Sponsored in part by United States - Japan Fast Reactor Exchange Program
(JAPFNR-189; N-951-74-12) Avail: ERDA Depository Libraries HC $5.50

Tests of carbide materials, refractory materials such as molybdenum and tungsten as well as stellite No. 6, nickel, nichrome, etc. revealed the following results: (1) chrome carbide (detonation gun-coated) has a good self-weld resistance, but the carbide with tungsten showed a strong tendency to self-weld; (2) tungsten and molybdenum had a strong resistance against self-welding; (3) stellite No. 6 combined with SUS316 showed a tendency to self-welding; and (4) nickel and nichrome showed complete self-welding by forming a diffusion layer in the boundary zone. It was confirmed that such self-welding phenomena appearing in those components contacting with each other in high-temperature sodium are problems not to be regarded lightly. Author (NSA)

N76-11444# Imperial Coll. of Science and Technology, London (England).
A LITERATURE REVIEW OF INVESTIGATIONS IN THE

ACTIVITY OF PHOSPHORUS-CONTAINING LOAD-CARRYING ADDITIVES
Lynne Beynon 1975 58 p refs Prepared for Westland Helicopters Ltd.
(Contract K/25a/535/C.B.A.12(b))
(BR37055; S/T-Memo-1/75) Avail: NTIS HC $4.50

Surface distress of spiral bevel gears used in helicopter transmission systems was studied. A literature survey was made on lubricants incorporating load-carrying additives with emphasis on those containing phosphorus compounds. Papers dealing with compounds having extreme pressure and antiwear additives were considered and phosphorus containing materials detailed.
Author (ESA)

N76-11445# Wisconsin Univ., Madison. Mathematics Research Center.
EVALUATION OF COATED ABRASIVE GRAIN GEOMETRY AND WEAR VIA CONTINUOUS TIME SERIES MODELS Summary Report
M. S. Phadke, F. A. Burney, and S. M. Wu Mar. 1975 30 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GP-40381)
(AD-A011018; MRC-TSR-1510) Avail: NTIS CSCL 11/11

The coated abrasive profiles are characterized using the second order continuous autoregressive model. Based on a two sided moving average representation of this model, expressions are derived to calculate the geometry (apex angle, base width and orientation) of an average grain. Experimental results and analysis for six new and one worn coated abrasive are presented; and the capability of the grain geometry parameters to quantize wear is discussed. GRA

N76-11446# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
SURVEY OF ADVANCED PROPULSION SYSTEMS FOR SURFACE VEHICLES Final Report, Oct. 1973 - Dec. 1974
Frederick R. Riddell Jan. 1975 203 p refs
(Contract DAHC15-73-C-0200)
(AD-A011848; P-1073; IDA/HQ-74-16706) Avail: NTIS CSCL 19/3

Future military needs in propulsion systems for surfaces vehicles are examined in order to provide guidance for Technology Base programs directed at improved engines, transmissions, thrusters and fuels. It is observed that there is a physical tendency for power-generating systems to grow heavier per horsepower as output increases. This trend runs counter to the requirements of more mobile vehicles which need more power for less weight. These effects are quantified and it is shown that the performance demands of many projected military surface vehicles severely restrict the propulsion system options that technology can provide. GRA

N76-11447# Union Carbide Corp., Tarrytown, N.Y. Linde Div.
RESEARCH ON MATERIALS FOR SUBMERGED ARC WELDING OF TITANIUM Final Report, 15 Jun. 1974 - 14 Jun. 1975
D. C. Hill and C. L. Choi Jun. 1975 31 p refs
(Contract N00014-74-C-0406)
(AD-A012409) Avail: NTIS CSCL 13/8

This report presents the results of a study of halides as candidate materials for submerged arc welding of titanium alloys. Criteria are defined for optimum performance and tests are performed to screen candidate fluxes. CaF2-base fused fluxes are determined to offer preferred welding characteristics. Four promising compositions are identified: CaF2, CaF2-(5%)BaCl2, CaF2-(5%) SrF2. SrCl2 and CaF2-(5%)BaCl2-(2%)LiF. Groove welds were made with CaF2 flux and Ti-6Al-2Cb-1Ta-1Mo wire. GRA

N76-11448# McDonnell Aircraft Co., St. Louis, Mo.
RELIABILITY OF STEP-LAP BONDED JOINTS Final Report
E. B. Birchfield, R. T. Cole, and L. F. Impellizzeri Apr. 1975 177 p refs
(Contract F33615-74-C-3015; AF Proj. 4364)
(AD-A012009; AFFDL-TR-75-26) Avail: NTIS CSCL 13/5

The objective of the program was an improved technology base of data and methods applicable to the efficient design of graphite-epoxy to titanium step-lap-bonded airframe joints that are optimized for reliability under military flight loading. A random spectrum was used in repeated load tests to establish a data base for defining lifetime and residual strength characteristics. Static strength tests were also conducted which show good comparison with prediction of an elastic-plastic analysis procedure. The static strength, residual strength and lifetime data were assumed to be from Weibull distributions. The shape and scale parameters for each of these distributions were calculated using the best linear unbiased (BLU) estimation procedure. Using these procedures wearout models were calibrated and checked, and conclusions concerning scaling, and translation of parameters were drawn. Tests were also conducted to determine the effect upon lifetime of load truncation, load frequency, relaxation time between missions, and temperature. GRA

N76-11449# Midwest Research Inst., Kansas City, Mo.
PERFORMANCE OF LUBRICANTS: OILS AND GREASES IN WEAR TESTS AND COMPACT MATERIALS IN BALL BEARINGS Final Technical Report, 2 Jan. 1972 - 31 Dec. 1974
Karl R. Mecklenburg May 1975 79 p refs
(Contract F33615-72-C-1374; AF Proj. 7340; AF Proj. 7343)
(AD-A011718; AFML-TR-75-32) Avail: NTIS CSCL 11/8

This final report for a 3-year contract contains the results of several projects conducted on the program. The first project was a long-term repeatability study on the four-ball wear testers. The work was done to assure that the two test machines were constant in performance. The data confirm that the machine performance was as constant as could be statistically expected, both from machine to machine and for each machine as a function of time. The second project was to conduct four-ball wear tests on various oils and greases to determine the ability of the lubricants to prevent wear at various conditions of speed, load, and temperature. Data from 1,320 tests on 246 materials are reported. The third and fourth projects were to determine performance lives of various greases on the Pope spindles and Navy spindle. Equipment descriptions and test results are included. The fifth project was grease testing in the Sikorsky rigs. This rig is described and test results presented. The Sikorsky rig test procedures do not appear to be well suited for research testing. The last project discussed was the long-term testing of lubricant compact materials in ball bearings. GRA

N76-11450# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
HYDROFLUIDIC SERVOVALVE DEVELOPMENT Final Report, Dec. 1973 - Dec. 1974
Holger C. Kent Jun. 1975 59 p
(Contract DAAJ02-74-C-0015; DA Proj. 1T1-62114-A-645)
(AD-A012235; W0565-FR; USAAMRDL-TR-75-21) Avail: NTIS CSCL 13/11

This report covers the analysis, detail design, fabrication, and evaluation of a poppet-type servovalve to be used in servoactuators for hydrofluidic stability augmentation systems. Initial analysis and design included review of poppet valve principles, various design configurations and preliminary tests of poppet valve operation and flow forces. Evaluation included static, dynamic, and limited environmental tests. Although servovalve performance requirements were not met, it was shown that poppet valving can be mechanized to operate as a servovalve in driving an actuator piston. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-11451# National Bureau of Standards, Washington, D.C.
CONSIDERATIONS IN THE USE OF SAMPLING PLANS FOR EFFECTING COMPLIANCE WITH MANDATORY SAFETY STANDARDS Final Report
V. L. Broussalian, A. J. Farrar, U. W. Lyons, C. O. Muehlhause,

and M. G. Natrella Jun. 1975 59 p refs
(COM-75-10920/7; NBSIR-75-697) Avail: NTIS HC $4.50 CSCL 05A

Various means available to a regulator for gaining compliance with mandatory safety standards were examined. Particular attention is given to his option of mandating a sampling plan or scheme along with the standard. It is concluded that this option as well as the others identified are all viable under suitable conditions and should be available to the regulator for his possible application on a case by case basis. GRA

N76-11452# Southwest Research Inst., San Antonio, Tex.
METHODOLOGY INVESTIGATION: A COMPARISON OF RELIABILITY TESTS FOR AVIONICS EQUIPMENT ONBOARD US ARMY HELICOPTERS Final Report, 3 Apr. 1972 - 30 May 1975
Daniel D. Kana Apr. 1975 41 p refs
(Contract DAAD05-72-C-0228; SwRI Proj. 02-3365)
(AD-A012062) Avail: NTIS CSCL 14/4

An investigation was conducted to determine which of several reliability tests provided a most realistic representation of field environments experienced by avionics equipment onboard U.S. Army helicopters. Originally the program was scheduled to test a total of twenty-five AN/ARC-115 radios in groups of five, where each group was subjected to a different reliability test. Flight tests, bench tests, AGREE tests, uniaxial vibration tests, and triaxial vibration tests were the selected environments in which the radios were to be operated under simulated conditions, functional checks performed as required, and any failures noted. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-11453*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
STRESS ANALYSIS OF ADHESIVE BONDED STIFFENER PLATES AND DOUBLE JOINTS
U. Yuceoglu and D. P. Updike Sep. 1975 32 p refs Sponsored in part by NSF
(Grant NGR-39-007-011)
(NASA-CR-145742; IFSM-75-73) Avail: NTIS HC $4.00 CSCL 20K

The general problem of adhesive bonded stiffener plates and double joints of dissimilar orthotropic adherends with transverse shear deformations are analyzed. Adhesive layers are assumed to be of an isotropic, elastic and relatively flexible material. It is shown that the stress distributions in the adhesive layers are very much dependent on the bending deformations in adherends. Also, it is found that, in the adhesive layer, maximum transverse normal stress is, in many cases, larger than the longitudinal shear stress and that both occur at the edge of the joint. The general method of solution developed is applied to several practical examples. Author

N76-11454# Advisory Group for Aerospace Research and Development, Paris (France).
STRUCTURAL RESPONSE TO IMPACT DAMAGE
Juergen Massmann Sep. 1975 21 p
(AGARD-R-633) Avail: NTIS HC $3.50

The complex problem of designing an aircraft structure in a manner to minimize its vulnerability to the impact damage of projectiles has always been a major concern of aircraft builders. A description of the vulnerability assessment of aircraft structures to projectile threats, including high explosive munitions is presented. The major elements of a structural vulnerability assessment are discussed, including development of a damage model, and strength model. Considerable experimental verification is included. Author

N76-11455*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT AND APPLICATIONS OF TWO COMPUTATIONAL PROCEDURES FOR DETERMINING THE VIBRATION MODES OF STRUCTURAL SYSTEMS
Raymond G. Kvaternik Washington Nov. 1975 66 p refs
(NASA-TN-D-7995; L-10279) Avail: NTIS HC $4.50 CSCL 20K

Two computational procedures for analyzing complex structural systems for their natural modes and frequencies of vibration are presented. Both procedures are based on a substructures methodology and both employ the finite-element stiffness method to model the constituent substructures. The first procedure is a direct method based on solving the eigenvalue problem associated with a finite-element representation of the complete structure. The second procedure is a component-mode synthesis scheme in which the vibration modes of the complete structure are synthesized from modes of substructures into which the structure is divided. The analytical basis of the methods contains a combination of features which enhance the generality of the procedures. The computational procedures exhibit a unique utilitarian character with respect to the versatility, computational convenience, and ease of computer implementation. The computational procedures were implemented in two special-purpose computer programs. The results of the application of these programs to several structural configurations are shown and comparisons are made with experiment. Author

N76-11456# Technische Hochschule, Vienna (Austria).
THE FRACTURE MECHANICS APPROACH IN STRUCTURAL DESIGN
Walter R. Sperr 1975 8 p refs In GERMAN; ENGLISH summary
(ICAF-Doc-795) Avail: NTIS HC $3.50

The concept of fracture mechanics in structural design was discussed by distinguishing between two engineering applications: (1) high-stressed thick-walled components, such as pressure vessels or turbine-rotor discs, which show relatively short critical crack lengths and plane strain conditions, and (2) thin-walled, stiffened components like aircraft shell structures. In the first case, the analysis deals with methods for the prevention of brittle fracture and crack initiation; difficulties may arise with the introduction of dynamic loads and corrosive effects on subcritical crack growth. In the second case, subcritical crack growth under random loads and the determination of the fracture strength of the components are of main interest. The advantage of a more simple theoretical approach in plane stress conditions is opposed by the necessity to introduce the influence of a large plastic zone at the crack tip. Practical applications of these concepts are given. Author

N76-11457# Naval Research Lab., Washington, D.C. The Shock and Vibration Information Center.
THE SHOCK AND VIBRATION DIGEST, VOLUME 7, NUMBER 11
R. Potter (Hewlett-Packard Co., Santa Clara, Calif.) Nov. 1975 92 p refs
Avail: NTIS HC $5.00

Various aspects of shock, vibration, noise, and related subjects were discussed. A paper was presented on a general theory of modal analysis for linear systems, which shows that the transfer matrix of a linear system can always be written in terms of modal (and bimodal) vectors associated with each pole in the s-plane. This theory is valid for nonsymmetric systems, for multiple poles, and for multiple modes at each pole. These modal and bimodal vectors represent homogeneous solutions to the system equations due to some initial deformation. Calculations of the original mass, stiffness, and damping matrices from these measured modal parameters are also described. Announcements of forthcoming short courses were given. Abstracts from the current literature were given for each area, followed by an author index. Finally, two papers were discussed in a literature review section, and three books were reviewed in the last section. Y.J.A.

N76-11458*# Cornell Univ., Ithaca, N.Y.
FINITE ELEMENT SHELL INSTABILITY ANALYSIS Final Technical Report

Nov. 1975 30 p refs
(Grant NGL-33-010-070)
(NASA-CR-145746) Avail: NTIS HC $4.00 CSCL 20K

Formulation procedures and the associated computer program for finite element thin shell instability analysis are discussed. Data cover: (1) formulation of basic element relationships, (2) construction of solution algorithms on both the conceptual and algorithmic levels, and (3) conduction of numerical analyses to verify the accuracy and efficiency of the theory and related programs therein are described. Author

N76-11459# Shock and Vibration Information Center (Defense), Washington, D.C.

THE SHOCK AND VIBRATION DIGEST, VOLUME 7, NUMBER 6

Jun. 1975 112 p refs
(AD-A012073) Avail: NTIS HC $5.50 CSCL 20/11

Articles and abstracts are presented on the subject of shock and vibration research. Topics discussed include unstable whirl phenomena in rotating machinery, analysis and design, computer programs, environments, phenomenology, experimentation, components, systems, approximate methods for determining the vibrational modes of membranes, and the vibration and stability of elastic systems subjected to follower forces. M.J.S.

N76-11460# Civil Aviation Dept., New Delhi (India). Technical Centre.

A METHOD TO DETERMINE THE FRACTURE TOUGHNESS OF A MATERIAL USING FATIGUE CRACK-PROPAGATION TESTS

N. Ranganathan Dec. 1974 8 p refs
(TN-119) Avail: NTIS HC $3.50

The rate of fatigue crack propagation and the stress intensity factor are used to determine the fracture toughness of an aluminum alloy. E.H.W.

N76-11461# California Univ., Livermore. Lawrence Livermore Lab.

STRESS ANALYSIS OF A RUPTURE DISK

R. W. Werne Apr. 1975 25 p refs
(Contract W-7405-eng-48)
(UCID-16761) Avail: NTIS HC $4.25

The results of an elastic stress analysis of the rupture disk for an internal pressure of 45.5 MPa (6600 psi) indicate that the maximum von Mises stresses occur in the membrane and are on the order of 483 to 690 MPa (70,000 psi). This far exceeds the yield of the membrane material of 207 MPa (30,000 psi). These high stresses are expected since the membrane is designed to burst at that design pressure. The von Mises stresses in the rest of the body are less than 138 MPa (20,000 psi). An elastic-plastic analysis of the membrane alone subjected to the 45.5 MPa (6600 psi) pressure indicates that it becomes plastically unstable and continues to deform under constant load. A second load case with a constant 6.9 MPa (1000 psi) pressure throughout the entire body (after release of pressure by burst of the membrane) was analyzed. The results indicate that the elastic von Mises stresses are less than 26.7 MPa (3880 psi) throughout the body. Author (NSA)

N76-11462# Loughborough Univ. of Technology (England). Dept. of Mathematics.

AUGMENTED PENALTY FUNCTION METHODS FOR THE FINITE ELEMENT OPTIMIZATION OF TURBINE BLADES

B. M. E. deSilva and G. N. C. Grant Mar. 1975 33 p refs
(MATHS-Res-54) Avail: NTIS HC $4.00

A comparative study is described of several algorithms based on the augmented or multiplier penalty function method for the minimization of centrifugal loading on a turbine blade subject to vibration constraint. The design requirements are represented by equality constraints using slack variables. Computational procedures include a study of different approximations to the Lagrange multiplier function and the penalty constant. The minimizations incorporate a combination of trajectory and quasi-Newton methods. The behavior calculations for the mass and stiffness matrices are based on a Timoshenko beam idealization. Author (ESA)

N76-11463# Loughborough Univ. of Technology (England). Dept. of Mathematics.

CONJUGATE GRADIENT OPTIMAL CONTROL METHODS FOR THE DESIGN OF TURBINE BLADES

B. M. E. deSilva, G. N. C. Grant, and B. L. Pierson (Iowa State Univ. of Sci. and Technol.) Mar. 1975 44 p refs
(MATHS-Res-55) Avail: NTIS HC $4.00

A turbine blade optimal control problem was studied in the context of two conjugate gradient algorithms incorporating control parameters, some unspecified initial state values, and terminal constraints. A penalty function modification of the Hamiltonian and a gradient projection algorithm were used to handle the constrained problem. The projection operator was developed for a control space which is the Cartesian product of the control parameters, the unspecified initial state values, and the control functions. The computational implementation of these methods and the results are discussed. Author (ESA)

N76-11464# Loughborough Univ. of Technology (England). Dept. of Mathematics.

PENALTY FUNCTION TYPE OPTIMAL CONTROL METHODS FOR THE DESIGN OF TURBINE BLADE PROFILES

B. M. E. deSilva, B. Negus, and J. Worster May 1975 32 p refs
(MATHS-Res-63) Avail: NTIS HC $4.00

Some computational techniques based on optimal control theory are described for the design of turbine blade profiles with vibration constraint. The methods include an epsilon-type transformation for incorporating system differential equations. Elliptical cross sectional shapes are assumed and resulting nonlinear programs are solved sequentially using penalty functions in conjunction with quasi-Newton methods. Alternately a finite difference discretization can be used with the state differential equations replaced by difference equations, resulting again in a constrained optimization problem. In the latter representation the vibrational frequencies have an eigenvalue structure while in the former cases they have the status of a control parameter. A numerical study of these methods and their implementation is presented together with a discussion of results. Author (ESA)

N76-11465# Southampton Univ. (England). Inst. of Sound and Vibration Research.

A SIMPLE MODEL OF A CFRP LAMINATED MATERIAL IN THE FORM OF A SANDWICH BEAM

R. J. Kershaw [1974] 54 p refs Sponsored by Min. of Defence
(ISVR-tr-71) Avail: NTIS HC $4.50

A simple model of a laminated carbon fiber reinforced plastic (CFRP) material is proposed, and equations of motion and boundary conditions are derived by a variational method. Damped normal modes are used in a parameter study of a symmetrical, cantilevered sandwich beam, which shows that the effect of interlaminar shear on the dynamic behavior of CFRP materials is likely to be small. Limitations of the model prevent quantitative deductions being made at this stage. Author (ESA)

N76-11466# Nederlands Scheeps-Studiecentrum TNO, Delft. Scheepsbouw Afdeling.

MEKON: A COMPUTER PROGRAM FOR CALCULATION OF DISPLACEMENT AND STRESS WITH MEMBRANE ELEMENTS IN CONSTRUCTIONS CONSISTING OF PLATES AND TRUSSES. USER'S MANUAL

G. Hommel (Tech. Hogeschool, Delft, Neth.) and J. H. Vink Sep. 1974 37 p In DUTCH; ENGLISH summary
(NSR-Mededel-38-s; TDCK-66028) Avail: NTIS HC $4.00

The information necessary for using the MEKON programs was given. These programs perform the analyses and control steps with which most types of input errors can be found. The memory capacity necessary during the execution of the calculations and the number of tracks to be reserved when disk memory is used can be calculated. The general description of the calculation programs gives a list of the elements used and the input, output, and matrix solution procedures. The various controls and the output of the control program are also given. Examples of the use of MEKON are discussed. ESA

N76-11467# Technological Lab. RVO-TNO, Rijswijk (Netherlands).

DUCTILITY FACTOR OF ARMED CONCRETE PLATES, PART 2 [DUCTILITY-FACTOR BIJ GEWAPEND BETONNEN PLATEN (DEEL 2)]

W. H. F. C. Eschbach 3 Mar. 1975 9 p In DUTCH Prepared for Adviesbur. der Genie

(Contract A73/KL/077-E-3140-II(9628))

(TL-1975-6; TDCK-66105) Avail: NTIS HC $3.50

Ductility calculations for an armed concrete plate were made by using the MARC-CDC computer program. The computer program is discussed and the results of the calculations are presented. It is concluded that a fundamental description of the ductility behavior is not possible because of the absence of a numerical description for rupture mechanism, stretch limitation, and Mohr-Coulomb behavior. ESA

N76-11468# Hawker Siddeley Dynamics Ltd., Hatfield (England).

STUDY OF THE ACOUSTIC EXCITATION OF STRUCTURES. VOLUME 2: A PROGRAMME TO EVALUATE THE RESPONSE OF STRUCTURES TO ACOUSTIC EXCITATION Final Report

A. Capps Paris ESA Jun. 1975 84 p

(Contract ESTEC-2143/73)

(ESA-CR-596) Avail: NTIS HC $5.00

A computer program in standard FORTRAN for evaluating the response of structure to reverberant fields is described. A detailed description of the user interfaces is given, as well as flow charts of subroutines of the program which, used in conjunction with the program listing, provide a guide to the coding itself. For the response evaluation the modal method is used. In this case the range of structures is united by the versatility of the finite element modelling techniques available to the user. The statistical energy method is used for flat plate and cylinder and variations on these themes. Model complexity is limited by program run time and cost and number of frequency steps used. The program automatically generates graph plotter files for subsequent use with a graph plotting program. For volume 1, see N75-20464. ESA

N76-11469# Arbeitsgruppe fuer Ballistische Forschung, Weil am Rhein (West Germany).

FRAGMENTATION EFFECTS AGAINST HARD TARGETS [SPLITTERWIRKUNG GEGEN HARTE ZIELE]

H. Senf Sep. 1974 81 p refs In GERMAN Presented at the seminar "Geschosswirkung", Mannheim, West Ger., 30 Sep. - 4 Oct. 1974

(ABF-E-7/74) Avail: NTIS HC $5.00

The penetration of spheres in semi-infinite hard targets, as an example for performed splinters, was investigated as a function of terminal velocity, sphere diameter, chemical composition, and physical properties of projectile and target materials. A method is described for determining velocities, flight direction, and effect of natural splinters. The results of these investigations represent input data for the terminal ballistic investigations with model splinters. Several theoretically and empirically derived formulas describing the ballistic terminal and residual velocities are discussed and their validity investigated. ESA

N76-11470# Institut fuer Festkoerpermechanik, Freiburg (West Germany).

INTERACTION OF MULTIPLE CRACKS

L. Hodulak and G. Klein Dec. 1974 53 p refs In GERMAN; ENGLISH summary

(IFKM-WB-7/74) Avail: NTIS HC $4.50

Stress intensity factors for simple systems of interacting cracks were computed and in some cases experimentally measured. Multiple cracks arranged either in parallel or collinearly or both, and the rotation of one crack relative to another, were examined as simple examples. Numerical results were obtained by using a solution for systems of integral equations, the experimental results by using an improved photoelastic method. The results allow a better estimation of stress intensity factors for real multiple cracks. The implications of the results for the safety of structural components, especially those in nuclear reactors, are considered. In particular the recommendations of the ASME Boiler and Pressure Vessel Code are compared with some of the results of this work. It is shown that for crack configurations where the loading includes Mode II the ASME Code underestimates the critical load (depending on the fracture criterion), by up to 20% in cases where the cracks are separated more than one crack length and are assumed by the code to be non-interacting. For closer spacings the ASME code usually overestimates the critical load. Author (ESA)

N76-11471# Institut fuer Festkoerpermechanik, Freiburg (West Germany).

[ACTIVITIES OF THE INSTITUTE OF SOLID STATE TECHNOLOGY] Annual Report, 1974 [JAHRESBERICHT 1974]

[1975] 46 p refs In GERMAN

Avail: NTIS HC $4.00

Investigations of stress analysis, strength of materials, and fracture mechanics are reported. The technology of accident prevention through improving security e.g. of pressure vessels of reactors and pressure ducts is considered. Organization and financing are for the institute outlined, and research papers completed and published in 1974 are listed. ESA

N76-11472# European Space Agency, Paris (France).

A NEW DEVICE FOR THE VIBRATORY EXCITATION OF MECHANICAL STRUCTURES

Jean-Francois Boisseau Sep. 1975 45 p refs Transl. into ENGLISH of "Un Nouveau Dispositif d'Excitation Vibratoire de Struct. Mecan.", ONERA, Paris Report ONERA-NT-223, 1974

(ESA-TT-184; ONERA-NT-223) Avail: NTIS HC $4.00

Vibration generators are described which include a rotating mobile dynamically balanced element, driving a mass in a linear movement along an unlimited travel. The rotation kinetic energy of the mechanism and the kinematic ratio are optimized for the required conditions (available force, expected perturbations, and mass participation in the excited structure). The proposed solutions present some interesting properties which lie between those of the reversible electrodynamic and the irreversible hydraulic generators. Ground and flight test results on several models (force 40 to 450 N and travel 50 to 450 mm) were in good agreement with the calculations and known results. Other applications are being considered for heavy structures excited between 0.1 and 30 Hz, in harmonic and random modes. Author (ESA)

N76-11473# Naval Ordnance Station, Louisville, Ky.

FEASIBILITY STUDY OF CYCLIC PRESSURE TESTING THICK-WALLED CYLINDERS Final Report

Jan. 1975 62 p refs

(AD-A012368; NOSL-MT-026) Avail: NTIS CSCL 19/6

This study was initiated to investigate the feasibility of cyclic pressure testing thick-walled cylinders using electrohydraulic energy. The primary intended end use is an economical means of cyclic loading Naval Gun Barrels to safely determine their fatigue life. Preliminary examination was conducted on sample sections of a 5-inch gun barrel to verify design of end restraints, parabolic shaper, and reflector. Energy levels of 42 and 52 kilojoules (8,000 and 10,000 volts) were used, and pressures in the order of 40,000 to 68,000 psi were generated. From this data, further tests were conducted with an electrohydraulic equipment manufacturer to examine rapid cycling and pressure measuring equipment. The results obtained substantiate the use of the technique for cyclic pressure testing; however, it is considered that additional work is needed to design and produce more reliable components to optimize the process. GRA

N76-11474# Iowa Univ., Iowa City. Div. of Materials Engineering.

OPTIMAL DESIGN OF ELASTIC STRUCTURES UNDER DYNAMIC LOADS Ph.D. Thesis. Final Technical Report, Nov. 1973 - Apr. 1975

T. T. Feng, J. S. Arora, and E. J. Haug, Jr. May 1975 141 p refs

(Grant DAHC04-74-G-0040)

(AD-A012212; AC-CR-75-006; FTR-18) Avail: NTIS CSCL 20/11

In this report, optimal design of elastic structures under dynamic loads is considered. A general objective functional for the problem is defined, and a functional treatment of the transient dynamic response constraints (stress and displacement constraints) is presented. Constraints on the natural frequency of the structure and the design variables are also included. The

general method developed for this class of problems is then applied to truss-frame structures. GRA

N76-11475# New Mexico Univ., Albuquerque. Eric H. Wang Civil Engineering Research Facility.

APPLICABILITY OF ACOUSTIC-EMISSION TECHNIQUES TO CIVIL ENGINEERING RESEARCH Final Report, 21 Jan. - 30 Jun. 1974

Larry W. Bickle and Adalbert J. Smiel Jun. 1975 104 p refs (Contract F29601-74-C-0030)

(AD-A012210; AFWL-TR-74-299) Avail: NTIS CSCL 13/2

When a solid undergoes a plastic deformation or fracture, part of the stored strain energy is released as elastic stress waves which can be sensed by sophisticated instrumentation. These stress waves are termed acoustic emissions even though the amplitudes and frequencies involved are usually outside the audible range. This study demonstrated that acoustic emission technology is becoming increasingly more suitable for field applications in civil engineering. Further research relating to reinforced concrete, soils, paving materials, and passive transducers is clearly justified. GRA

N76-11476# Southwest Research Inst., San Antonio, Tex.

SIMULTANEOUS AND RUNNING IMPULSIVE LOADING OF CYLINDRICAL SHELLS Final Report

Roger L. Bessey and J. C. Hokanson Jun. 1975 75 p refs (Contract DAAD05-72-C-0229; DA Proj. 1T0-61102-A-14B) (AD-A012268; SwRI-02-3358; BRL-CR-237) Avail: NTIS CSCL 19/4

Impulsive loading was performed on silica phenolic-bond and bare aluminum and lead cylindrical shells in the fixed-end configuration. The shells were loaded with 180 degree circumferential cosine loading distributions using stripped sheet explosive or spray-deposited silver acetylide-silver nitrate explosive. Values for the peak specific impulse needed to produce minimum lethality damage to the structures (wall displacements on the order of a radius) were obtained for the four different types of structures. The dependence of these values on the simultaneity of initiation and type of running load (i.e., longitudinal or circumferential) was ascertained for the structures where the overlap in the loading value between the sheet and sprayed explosive load required to produce lethality damage made it possible. GRA

N76-11477# Syracuse Univ., N.Y. George Sachs Fracture and Fatigue Research Lab.

CRACK TIP STRAIN: A COMPARISON OF FEM CALCULATIONS AND MEASUREMENTS

Wan-liang Hu and H. W. Liu Apr. 1975 26 p refs (Grant DAHC04-74-G-0165)

(AD-A012217; ARO-11961.1-E) Avail: NTIS CSCL 11/6

Earlier crack tip strain measurements have shown a definitive three dimensional effect upon crack tip deformation. In this study, a pseudo three dimensional Finite element method (FEM) calculation is made with a composite stiffness matrix. The calculated strains agree exceedingly well with the experimental measurements. The degree of crack tip stiffening is equivalent to only 4% of the plane strain plastic zone along the crack front in a 1/4 inch thick aluminum speciment, and 8% for a 1/2 inch thick speciment. Both specimens are loaded considerably beyond general yielding. The results cast serious doubt upon the premise that the specimen, with extensive plastic deformation, can be used to determine plane strain fracture toughness. GRA

N76-11478# California Univ., Berkeley. Earthquake Engineering Research Center.

STATIC AND DYNAMIC ANALYSIS OF NONLINEAR STRUCTURES

Digambar P. Mondkar and Graham H. Powell 11 Jun. 1975 168 p refs (Grant NSF GI-36387)

(PB-242434/9; EERC-75-10) Avail: NTIS HC $6.75 CSCL 13M

Theoretical and computational procedures are reported which have been applied in the design of a general purpose nonlinear computer code for static and dynamic analysis of nonlinear structures. Using the principle of vitual displacements, incremental equations of motion for structures undergoing large displacements and strains are first derived, using the Lagrangian description of deformation. These equations of motion are then discretized using the finite element displacement formulation, and the element characteristics, including linear and nonlinear stiffness matrices, are derived for the particular case of a two dimensional isoparametric finite element. Physical nonlinearity due to material behavior is introduced for elasto-plastic materials. GRA

N76-11479# Aeronautical Research Associates of Princeton, Inc., N.J.

A FORMULATION OF THE GLOBAL EQUATIONS OF MOTION OF A DEFORMABLE BODY Interim Report, 15 Jan. 1974 - 14 Jan. 1975

Thomas B. McDonough Mar. 1975 24 p refs (Contract F44620-74-C-0045; AF Proj. 9782)

(AD-A011733; ARAP-240; AFOSR-75-0815TR) Avail: NTIS CSCL 20/11

The global equations of motion for a deforming body are cast in a form which is attractive for many studies. The deforming body is assumed a continuum, but its constitutive behavior is left totally general. Equations treated represent the conservation of linear and angular momenta and kinetic energy. The motion -- including deformation - of the body is of unrestricted magnitude. A translating and rotating reference frame is defined in terms of the linear and angular momenta of the body, and the global equations of motion are transformed in terms of parameters which are defined relative to this reference frame. It is defined so that the body possesses zero momenta as seen by an observer fixed in the reference frame. It is also shown that for a given motion, this choice of reference frame minimizes the kinetic energy of the body measured relative to the reference frame. The global equations are represented in a form similar to the classical rigid-body equations, which are shown to follow on the assumption of zero stretching. Finally, the conditions for steady motion are developed. Solutions are presented for steady motion and when the angular velocity has only steady direction. GRA

N76-11480# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.

SINGER: A COMPUTER CODE FOR GENERAL ANALYSIS OF TWO-DIMENSIONAL REINFORCED CONCRETE STRUCTURES. VOLUME 3: USER'S GUIDE Final Report, Aug. 1972 - Aug. 1974

R. J. Melosh, R. M. Barker, and S. M. Holzer May 1975 91 p (Contract F29601-73-C-0022)

(AD-A011585; AFWL-TR-74-228-Vol-3) Avail: NTIS CSCL 13/13

This document is a user's guide to the SINGER computer program. The guide defines the form and interpretation of input and output data. SINGER predicts the transient response of two dimensional reinforced concrete frames subjected to time varying loadings, accounting for nonlinear material effects and large geometry changes. GRA

N76-11481# Pennsylvania State Univ., University Park. Applied Research Lab.

COMPOUND MOUNTING SYSTEMS THAT INCORPORATE DYNAMIC VIBRATION ABSORBERS

J. C. Snowdon May 1975 40 p refs (Contract N00017-73-C-1418)

(AD-A011422) Avail: NTIS CSCL 13/9

The transmissibility across novel compound or two-stage mounting systems is discussed, and representative calculations of transmissibility are compared for systems with intermediate stages that comprise either (1) a rigid mass plus a dynamic vibration absorber, (2) dual beams loaded symmetrically by equal lumped masses, or (3) dual beams to which multiple dynamic vibration absorbers are attached. In the first case, the undesirable secondary resonance of the compound system can be suppressed effectively by the dynamic vibration absorber, for which appropriate design data are given. In the latter cases, lumped masses or dynamic vibration absorbers are applied to each intermediate beam of the compound system at the locations of the four upper mounts that support the vibrating item from below. In turn, the beams are supported at each end by single antivibration mounts on a rigid foundation. GRA

42 GEOSCIENCES (GENERAL)

N76-11482*# National Aeronautics and Space Administration, Washington, D.C.
SEASAT-A SCIENTIFIC CONTRIBUTIONS
Jul. 1974 172 p refs
(NASA-TM-X-72944) Avail: NTIS HC $6.75 CSCL 05B

SEASAT-A planned instrument complement and capabilities are reported together with an estimate of expected scientific contributions from satellite oceanic measurements. For individual titles, see N76-11483 through N76-11508.

N76-11483* National Aeronautics and Space Administration, Washington, D.C.
A SYNOPSIS OF SEASAT-A SCIENTIFIC CONTRIBUTIONS
John R. Apel (NOAA) and Joseph W. Siry *In its* Seasat-A Sci. Contrib. Jul. 1974 p 3-30 refs (For availability see N76-11482 02-42)
CSCL 08E

SEASAT-A satellite data processing and modelling capabilities address scientific and applications problems in the domains of oceanic, atmospheric, and solid earth geophysics studies by the use of active radar, and passive microwave and infrared instruments. A data flow map depicts the interrelationship between SEASAT-A instruments and other sources of information and the geophysical parameters to be determined. G.G.

N76-11484* Lockheed Missiles and Space Co., San Diego, Calif. Ocean Lab.
COMMENTS ON POTENTIAL SEASAT APPLICATIONS
Ledolph Baer *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 33-37 ref (For availability see N76-11482 02-42)
CSCL 08E

Potential benefits of expected SEASAT-A capabilities include oceanographic support of industrial and commercial activities, rapid dissemination of data in forecast-type activities, greater monitoring abilities at better spatial resolutions, and long time operational data gathering. G.G.

N76-11485* Woods Hole Oceanographic Institution, Mass.
COMMENT ON SATELLITE ALTIMETER DATA **c43**
Carl Bowin *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 38 ref (For availability see N76-11482 02-42)
CSCL 09F

SKYLAB mission SEASAT-B altimeter observations in combination with surface gravity measurements provide useful data on the marine geoid and expected ocean perturbations from analyses of seamount structures. G.G.

N76-11486* National Oceanic and Atmospheric Administration, Princeton, N.J. Geophysical Fluid Dynamics Lab.
MEASUREMENTS OF TRANSIENT CURRENTS IN MID-OCEAN BY ALTIMETRY **c48**
Kirk Bryan *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 39-40 (For availability see N76-11482 02-42)
CSCL 08C

Evidence is put forward that SEASAT-A altimetry will be accurate enough to provide interesting information on transient currents in mid-ocean areas. The discussion rests on the assumption that the observed currents are largely in geostrophic equilibrium rather than due to local winds. Surface current velocities are determined by integrating satellite navigation positions and dead reckoning data using an automatic log attached to a vessel hull. Author

N76-11487* National Oceanic and Atmospheric Administration, Miami, Fla.
GEOSTROPHIC CURRENT INVESTIGATIONS WITH SEASAT **c48**
H. Michael Byrne and William O. VonArx (Woods Hole Oceanographic Inst.) *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 41-44 (For availability see N76-11482 02-42)
CSCL 08C

The measurement of sea surface topology by SEASAT satellite allows for the detection of baroclinic or barotropic geostrophic flows, as well as the tracking of cyclonic cold core rings generated by currents. It is stipulated that SEASAT is the only system capable of measuring pressure and motion fields of a sea surface reliably, synoptically, and at an affordable cost. G.G.

N76-11488* Puget Sound Univ., Tacoma, Wash.
SEASAT AND POLAR ICE **c46**
W. J. Campbell *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 45-46 (For availability see N76-11482 02-42)
CSCL 08L

The instrument package for SEASAT-A possesses three tools that could give data greatly needed in ice cap research: the Compressed Pulse Radar Altimeter (CPRA), the Coherent Imaging Radar (CIR), and the Scanning Multifrequency Microwave Radiometer (SMMR). Certain problems that can be studied with each sensor are discussed. Author

N76-11489* Naval Research Lab., Washington, D.C.
GEODETIC CORRECTIONS AND RELATED INFORMATION FROM OCEANOGRAPHIC MEASUREMENTS MADE BY SEASAT-A **c46**
Davidson Chen *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 47-49 refs (For availability see N76-11482 02-42)
CSCL 08E

Oceanographic measurements taken by SEASAT-A are not only applicable to correct altimetry data for the desired geoid but also, as a result, they themselves are useful by-products for basic and applied research in the fields of sciences and engineering, exploratory development in sensor design and measurement techniques, and prediction products for operational fleet support. Among these measurements the important ones are current, sea state, and tides. Identified are parameters of the measurements which will be used to eliminate temporal environmental biases from geodetic measurements, and also to describe the physical processes involved. Author

N76-11490* National Oceanic and Atmospheric Administration, Rockville, Md.
SCIENTIFIC VALUE OF SEASAT FOR GEODESY **c46**
Bernard H. Chovitz *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 50-53 refs (For availability see N76-11482 02-42)
CSCL 08E

SEASAT altimetry data which relate directly to geoid heights provide the means to obtain information on the geoid on a global scale which is not attenuated by height or by high frequency averaging. The most important geodetic application of these data is to provide a standard reference surface for oceans. Author

N76-11491* Scripps Institution of Oceanography, La Jolla, Calif. Inst. of Geophysics and Planetary Physics.
OCEAN TIDES FROM SEASAT-A **c48**
M. C. Hendershott, W. H. Munk, and B. D. Zetler *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 54-56 refs (For availability see N76-11482 02-42)
CSCL 08C

Two procedures for the evaluation of global tides from SEASAT-A altimetry data are elaborated: an empirical method leading to the response functions for a grid of about 500 points from which the tide can be predicted for any point in the oceans, and a dynamic method which consists of iteratively modifying the parameters in a numerical solution to Laplace tide equations. It is assumed that the shape of the received altimeter signal can be interpreted for sea state and that orbit calculations are available so that absolute sea levels can be obtained. Author

N76-11492* National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
EXPECTED SEASAT-A SCIENTIFIC RESULTS **c82**
Frank E. Hoge *In its* Seasat-A Sci. Contrib. Jul. 1974 p 57-69 refs (For availability see N76-11482 02-42)
CSCL 05B

The higher accuracy and extended coverage of the SEASAT-A altimeter allows for the determinations of a highly refined geoid, of open ocean currents and circulations, of ocean subsurface topography, and of earth surface topography. The radar altimeter on SEASAT-A is also considered as a tracking station in orbit for range and range rate tracking work. G.G.

N76-11493* California Univ., Los Angeles.
BENEFITS TO THE STUDY OF OCEANIC TECTONICS EXPECTED FROM SEASAT-A **c48**
W. M. Kaula *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 70-73 refs (For availability see N76-11482 02-42)
CSCL 08J

A more detailed gravity field such as provided by the SEASAT-A altimeter would help resolve several problems of marine geology, such as the relationship of spreading rises to convective upstreams and the tectonics of subduction zones and the associated marginal basins. In addition, the gravity field should be measured in more detail over continental shelves accessible to mineral exploration. A secondary contribution of SEASAT-A would be to sedimentation processes, through its influence on models of ocean currents. Author

N76-11494* National Center for Atmospheric Research, Boulder, Colo.
SATELLITE OBSERVATIONS OF WEATHER AND CLIMATE **c47**
William W. Kellogg *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 74-78 refs (For availability see N76-11482 02-42)
CSCL 04B

The SEASAT-A program is viewed as a new way to obtain atmospheric observations for weather and climatic studies in the framework of the Global Atmospheric Research Program (GARP). Total information derived from SEASAT-A sensor package provides a synoptic picture of the upper parts of the world's oceans as a prerequisite to the development of dynamic ocean models and combined ocean/atmospheric models for weather forecasting requirements. G.G.

N76-11495* Battelle Columbus Labs., Ohio.
CIVIL AND SCIENTIFIC APPLICATIONS OF THE GEOID **c43**
A. George Mourad *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 79-84 (For availability see N76-11482 02-42)
CSCL 08B

SEASAT-A can be used for determining the geoid to much higher accuracy on a world wide basis and in a relatively short time. Two basic objectives can be considered: (1) determination of the geoid to at least 1 meter. This accuracy will satisfy most geodetic requirements for applications purposes; and (2) determination of the geoid to better than 1-meter an oceanographic objective required for measurement of sea surface topography and sea slope, quasi-stationary departure from the geoid, ocean circulation, air and sea interaction, etc. The geodesy objective in this case will be to define a reference equipotential surface as a means by which the oceanographic requirements can be achieved. Author

N76-11496* Naval Research Lab., Washington, D.C.
EXPLOITATION OF SEASAT-A OCEANOGRAPHIC MEASUREMENTS FOR NAVY R AND D APPLICATIONS **c48**
V. Noble *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 85-88 (For availability see N76-11482 02-42)
CSCL 08J

Basic research, exploratory development and operational demonstration potentials for exploitation of SEASAT-A data are discussed. Some of the interactions and tradeoffs in sensor design and measurement technology, and advanced development of environmental analysis and prediction products for operational fleet support are outlined. G.G.

N76-11497* City Coll. of the City Univ. of New York. Inst. of Oceanography.
THE SCIENTIFIC JUSTIFICATION FOR OBTAINING OCEAN WAVE DATA OF VARIOUS KINDS WITH SEASAT-A **c48**
Willard J. Pierson *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 89-94 (For availability see N76-11482 02-42) (Contract NAS5-20041)
CSCL 08C

Synthetic aperture radar images of sea surface in deep water as well as two candidate instruments that essentially scan along a line are considered for obtaining spectral wave information with SEASAT-A. An altimeter provides data on wave height for every 50 or 100 kilometers along subsatellite track routine. A combination of these instruments is proposed to obtain wind generated ocean waves and swells. G.G.

N76-11498* City Coll. of the City Univ. of New York. Inst. of Oceanography.
THE SCIENTIFIC JUSTIFICATION OF A RADAR SCATTEROMETER AND A PASSIVE MICROWAVE SYSTEM ON SEASAT-A **c32**
Willard J. Pierson *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 95-98 refs (For availability see N76-11482 02-42) (Contract NAS5-20041)
CSCL 17I

The purpose of these two systems is to determine the winds over the ocean. The passive system may also provide data on precipitation over the ocean and sea surface temperature through clouds. They complement each other. The radar scatterometer will sense those sea surface properties that define the winds over the ocean through clouds so thick and so wet that the passive microwave system will have detected only the cloud properties. Both wind speed and direction can be found from the combined data to be obtained. Author

N76-11499* Coast Guard, Washington, D.C. Oceanography Unit.
ADVANTAGES OF AN OCEANOGRAPHIC SATELLITE IN THE STUDY OF OCEAN CURRENT SYSTEMS **c48**
R. Q. Robe *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 99-100 (For availability see N76-11482 02-42)
CSCL 08C

SEASAT-A instruments for the study of oceanic currents are: a scanning radiometer with a temperature resolution of about + or - 1 C for locating ocean fronts by thermal difference, and a precision altimeter for monitoring sea surface slopes that drive major ocean currents. G.G.

N76-11500* Naval Research Lab., Washington, D.C.
COMMENTS ON NAVY/NRL REQUIREMENTS FOR SEA SURFACE TEMPERATURE AND SURFACE WIND MEASUREMENTS ON SEASAT-A **c48**
R. E. Ruskin and R. K. Jeck, Jr. *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 101-102 (For availability see N76-11482 02-42)
CSCL 08J

SEASAT instrumentation payload requirements to provide satellite data for the Navy fleet operational fog prediction program include: (1) some form of C-band microwave radiometer capability; (2) a scanning antenna with a 40-km Instanteneous Field of View (IFOV) for the C-band channel; (3) a narrow band and high resolution IR scanning radiometer for cloud free areas; and (4) a capability for measuring surface winds of 3 to 50 m/sec at + or - 10% accuracy and 50 to 100 km spatial resolution. G.G.

N76-11501* Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
ON THE REMOTE SENSING OF DIRECTIONAL WAVE SPECTRA AND SURFACE WINDS **c48**
O. H. Shemdin *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 103-108 refs (For availability see N76-11482 02-42)
CSCL 08C

The potential benefits of remote SEASAT-A satellite sensing of wind directional wave spectra by active microwave systems are elaborated. It is shown that a combined effort which uses supplemental satellite information in numerical forecasting and hindcasting schemes upgrades the accuracy of existing forecasting methods of an order of magnitude. G.G.

N76-11502* National Environmental Satellite Service, Washington, D.C.
MICROWAVE MEASUREMENT OF SEA SURFACE TEMPERATURE **c48**
John W. Sherman, III and P. Kirshna Rao *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 109-123 refs (For availability see N76-11482 02-42)
CSCL 08J

SEASAT-A microwave radiometry is considered for scientific studies related to sea surface temperature measurements. Its

limited swath width negates certain studies at angles greater than about 30 deg from nadir. Symmetrical scans appear best for operational experiments. It is recommended that a mode of scan be incorporated which permits data to be collected from nadir up to 11 55-60 deg from nadir, even if a symmetrical scan is necessary. G.G.

N76-11503* Naval Weapons Lab., Dahlgren, Va.
POTENTIAL CONTRIBUTIONS OF SEASAT-A TO GEODETIC SCIENCE **c46**
Samuel L. Smith, III *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 124-125 (For availability see N76-11482 02-42)
CSCL 08E

It is projected that SEASAT-A will provide high resolution ocean coverage between the 72 deg latitude lines that gives data on most of the non-permanently frozen ocean areas. Data gathered by SEASAT-A in combination with terrestrial gravimetry data and orbit perturbation data allow for the computation of a worldwide geoid and gravity field with high accuracy and spatial resolution. G.G.

N76-11504* Scripps Institution of Oceanography, La Jolla, Calif.
SATELLITE MEASUREMENTS OF OCEAN WAVES **c48**
Robert H. Stewart *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 126-127 ref (For availability see N76-11482 02-42)
CSCL 08C

Satellite measurements of the directional spectrum of ocean waves are beneficial to theoretical wave research, ocean engineering, and marine activities. Wave measurements from satellites by active microwave systems also help to analyze those processes that govern the transfer of heat, water vapor, and momentum across the air-sea interface. G.G.

N76-11505* Florida State Univ., Tallahassee.
PHYSICAL OCEANOGRAPHY FROM SATELLITES: CURRENTS AND THE SLOPE OF THE SEA SURFACE **c48**
W. Sturges *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 128 refs (For availability see N76-11482 02-42)
CSCL 08J

A global scheme using satellite altimetry in conjunction with thermometry techniques provides for more accurate determinations of first order leveling networks by overcoming discrepancies between ocean leveling and land leveling methods. The high noise content in altimetry signals requires filtering or correction for tides, etc., as well as carefully planned sampling schemes. G.G.

N76-11506* Coastal Engineering Research Center, Fort Belvoir, Va.
EXPECTED SCIENTIFIC YIELD OF SEASAT-A AND ITS APPLICATION TO CORPS OF ENGINEERS PROGRAMS **c82**
P. G. Teleki *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 129-133 (For availability see N76-11482 02-42)
CSCL 05B

The Corps of Engineers interest in SEASAT-A is a natural outgrowth of its mission to protect and manage the Nation's shorelines. In regard to the expected payload on SEASAT-A the following general study areas can be identified: gravity waves, wind waves, wind-wave interaction, storms and hurricanes, ice, coastal currents, tsunamis, and to a very small extent geoid modelling as it applies to determination of sea level and tides. Author

N76-11507* Army Cold Regions Research and Engineering Lab., Hanover, N.H.
SEASAT AND FLOATING ICE **c46**
W. F. Weeks *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 134-135 (For availability see N76-11482 02-42)
CSCL 08L

Data collected by SEASAT would be useful in developing predictive physical models for the drift and deformation of sea ice, for estimating the heat budget of the polar seas, for the optimum routing of shipping through pack ice areas, for the design of both offshore structures and shipping capable of surviving in heavy pack ice, and for the tracking of large icebergs and ice islands. The instrument package for SEASAT-A is particularly useful for studying sea ice in that the Coherent Imaging Radar (CIR), the Scanning Multifrequency Microwave Radiometer (SMMR) and the Compressed Pulse Radar Altimeter (CPRA) are not limited by the presence of clouds. Author

N76-11508* National Aeronautics and Space Administration, Washington, D.C.
THE EARTH AND OCEAN PHYSICS APPLICATIONS PROGRAM (EOPAP). OCEAN DYNAMICS PROGRAM
John R. Apel (NOAA) and Joseph W. Siry *In its* Seasat-A Sci. Contrib. Jul. 1974 p 139-151 refs (For availability see N76-11482 02-42)
CSCL 08E

SEASAT-A is a research oriented program consisting of a spacecraft, precision ground tracking systems, and data processing and modelling capabilities that address both scientific and application programs problems in ocean surface dynamics for the EOPAP program. An array of active radar and passive microwave and infrared instruments allows for quantitative measurements of oceanic, atmospheric, and geodetic parameters under stormy wind and wave conditions, as well as over regions lying under a cloud cover. G.G.

N76-11509# Joint Publications Research Service, Arlington, Va.
EXPLORATION OF EARTH RESOURCES BY SPACE METHODS
Yu. K. Khodarev, ed. 6 Oct. 1975 78 p refs Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 p 3-94 Presented at a meeting of a working group from Socialist Countries on Exploration of Earth Resources by Space Methods, Baku, 21-27 Apr. 1975 (JPRS-65858) Avail: NTIS HC $5.00

Remote sensing by satellites is used to evaluate various earth resources, such as forests, soils, oceans, farm crops, and climate. General and thematic maps are produced using less work expenditures. Soyuz-12 observations are briefly considered. For individual titles, see N76-11510 through N76-11516.

N76-11510 Joint Publications Research Service, Arlington, Va.
APPLICATION OF SPACE SURVEY MATERIALS IN SOLVING THEORETICAL AND PRACTICAL PROBLEMS IN GEOLOGY **c46**
V. N. Bryukhanov, V. K. Yeremin, V. I. Makarov, G. V. Makhin, B. N. Mozhayev, V. G. Trifonov, and P. V. Florenskiy *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 3-15 refs Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 13 p (For availability see N76-11509 02-42)

Photographic surveys (visible and near infrared) were successfully tested covering the wavelength range from 0.4 to 0.9 microns for geologic information. Space surveys were obtained by both photographic and television-scanner methods. Small scale, increased coverage, natural generalization, and increased interpretation effectiveness were characterized. Automation of geologic interpretation is proposed. J.A.M.

N76-11511 Joint Publications Research Service, Arlington, Va.
GEOGRAPHIC PROBLEMS AND THE POSSIBILITIES OF THEIR SOLUTION BY AEROSPACE METHODS **c43**
S. V. Zonn *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 16-23 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 8 p (For availability see N76-11509 02-42)

The principal geographic problems are discussed: (1) conservation and rational exploitation of the earth's natural resources as the basis for human life; (2) determination of multisided interaction between modern society and environment and the intensity of man's effect on nature; and (3) prediction of the state of the earth's reproducible resources and different kinds of severe natural phenomena. Visual interpretation, instrumental processing, and visual-instrumental approach are used to study remote sensor results. Agriculture and geomorphology are studied on spaceborne photography. J.A.M.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N76-11512 Joint Publications Research Service, Arlington, Va.
PRINCIPLES AND METHODS FOR STUDYING FORESTS FROM SPACE **c43**
A. S. Isayev and D. M. Kireyev *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 24-29 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 6 p (For availability see N76-11509 02-42)

An important factor in space observation of forests is the regularity of collection of repeated information which gives the changes in a dynamic system such as a forest. From satellites, it is possible to register the mass multiplication of forest pests, forest fires, wind and storm falls over great areas, floods, inundations and waterlogging within the limits of coastal zones. J.A.M.

N76-11513 Joint Publications Research Service, Arlington, Va.
PROBLEMS IN REMOTE SENSING OF LAND RESOURCES AND AGRICULTURAL CROPS **c43**
G. S. Yelesin *In its* Exploration of Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 30-35 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 6 p (For availability see N76-11509 02-42)

It is possible to distinguish the following levels of information use for land resources and sown areas of agriculture by remote methods: (1) farm, (2) region, (3) oblast, (4) union republic, and (5) the country as a whole. The need for routine information on agricultural processes, such as sowing, cultivation, and harvesting, is emphasized. Aerospace techniques can provide this data for agriculture, as well as information on natural calamities. J.A.M.

N76-11514 Joint Publications Research Service, Arlington, Va.
FUTURE POSSIBILITY OF INVESTIGATING THE OCEAN USING ARTIFICIAL SATELLITES **c48**
K. N. Fedorov and V. Ye. Sklyarov *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 36-48 refs Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 13 p (For availability see N76-11509 02-42)

The temperature field and level changes of the ocean surface were measured by remote sensors onboard artificial satellites. Radars and lasers were found promising for measuring waves. Ice cover, coastal zones, ocean bottom, and buoys are also being studied by satellite sensors. J.A.M.

N76-11515 Joint Publications Research Service, Arlington, Va.
USE OF MATERIALS FROM SPACE SURVEY FOR COMPILING AND REVISING GENERAL GEOGRAPHIC AND SPECIAL MAPS **c43**
Yu. G. Kelner and G. N. Romankevich *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 49-54 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 6 p (For availability see N76-11509 02-42)

Topographic map revision and development of new types of cartographic documents are considered, using satellite observation data. The decrease in work due to the space surveys is shown graphically for compilation and editing of general and thematic maps. J.A.M.

N76-11516 Joint Publications Research Service, Arlington, Va.
USE OF MULTIZONAL SPACE SURVEYS IN GEOGRAPHIC RESEARCH AND SPECIAL MAPPING **c43**
V. I. Kravtsova *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 55-76 refs Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 22 p (For availability see N76-11509 02-42)

Soyuz-12 data were used to study oceanography, hydrology, soils, geology, forests, geography, and meteorology. Salinization of soil forming rocks, image density of sands and solonchaks, shallow water, turbid water, underwater relief, and solar radiation penetration into sea water are presented in graphic form. J.A.M.

N76-11517* National Aeronautics and Space Administration, Washington, D.C.
SPACE SATELLITE TO AID ARCTIC OIL DEVELOPMENT
28 Oct. 1975 7 p
(NASA-News-Release-75-282) Avail: NASA Scientific and Technical Information Facility P. O. Box 8756, Baltimore/Washington International Airport, Md. 21240 CSCL 08G

A project which utilizes the Nimbus-6 weather satellite and air-dropable data collection platforms for observation of Arctic ice movement is described. The information gained from the project could be valuable for planning oil recovery operations in the area. D.M.L.

N76-11518*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Oct. 1975
Paul M. Merifield, Principal Investigator 8 Oct. 1975 2 p EREP
(Contract NAS2-7698)
(E76-10020; NASA-CR-145390; MPR-28) Avail: NTIS HC $3.50 CSCL 08G

There are no author-identified significant results in this report.

N76-11519*# Geological Survey, Reston, Va.
PROCESSING OF ERTS IMAGERY FOR DISSEMINATION PURPOSES Quarterly Progress Report, 18 May - 18 Aug. 1975
Hugh B. Loving, Principal Investigator 18 Aug. 1975 10 p ERTS
(Contract NAS5-3999A)
(E76-10021; NASA-CR-145414) Avail: NTIS HC $3.50 CSCL 05B

The author has identified the following significant results. This work reveals that the normal color composite rendition of land areas is not suitable for the depiction of clear shallow seas where optimum depiction of the sea bottom is critical. Either in the digital or analog, domain response must be altered from that now employed for land areas.

N76-11520*# Brevard County Planning Dept., Titusville, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Progress Report, 12 May - 11 Aug. 1975
John W. Hannah (NASA. Kennedy Space Center), Garland L. Thomas, Fernando Esparza, Principal Investigators, and James J. Millard (NASA. Kennedy Space Center) 11 Aug. 1975 24 p ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20907)
(E76-10022; NASA-CR-145415; BCPD-L2-2) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. St. Johns National Wildlife Refuge, a 4000 acre marsh, was established primarily to protect the Dusky Seaside Sparrow. A vegetation map of the refuge based on ground observations and color infrared photography was made. The preferred habitat of this sparrow is high-to-medium density spartina (a marsh grass) with no trees nearby. An increase in spartina density corresponds to an increase in marsh wetness. A thematic map shows the birds habitat preferences.

N76-11521*# Arizona Univ., Tucson. Office of Arid Lands Studies.
A STUDY TO EXPLORE THE USE OF ORBITAL REMOTE SENSING TO DETERMINE NATIVE ARID PLANT DISTRIBUTION Final Report, Jul. 1971 - Dec. 1974
W. G. McGinnies, Principal Investigator, J. S. Conn, E. F. Haase,

L Lepley, K., H. B. Musick, and K. E. Foster Jun. 1975 75 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21812)
(E76-10023; NASA-CR-145416) Avail: NTIS HC $4.50 CSCL 08F

The author has identified the following significant results. Research results include a method for determining the reflectivities of natural areas from ERTS data taking into account sun angle and atmospheric effects on the radiance seen by the satellite sensor. Ground truth spectral signature data for various types of scenes, including ground with and without annuals, and various shrubs were collected. Large areas of varnished desert pavement are visible and mappable on ERTS and high altitude aircraft imagery. A large scale and a small scale vegetation pattern were found to be correlated with presence of desert pavement. A comparison of radiometric data with video recordings shows quantitatively that for most areas of desert vegetation, soils are the most influential factor in determining the signature of a scene. Additive and subtractive image processing techniques were applied in the dark room to enhance vegetational aspects of ERTS.

N76-11522*# Oregon State Univ., Corvallis.
INVENTORY AND MONITORING OF NATURAL VEGETATION AND RELATED RESOURCES IN AN ARID ENVIRONMENT: A COMPREHENSIVE EVALUATION OF ERTS-1 IMAGERY Progress Report, Jul. 1972 - Apr. 1974
Barry J. Schrumpf, Principal Investigator, James R. Johnson, David A. Mouat, and William T. Pyott Dec. 1974 347 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21831)
(E76-10024; NASA-CR-145417) Avail: NTIS HC $10.00 CSCL 08F

The author has identified the following significant results. A vegetation classification, with 31 types and compatible with remote sensing applications, was developed for the test site. Terrain features can be used to discriminate vegetation types. Elevation and macrorelief interpretations were successful on ERTS photos, although for macrorelief, high sun angle stereoscopic interpretations were better than low sun angle monoscopic interpretations. Using spectral reflectivity, several vegetation types were characterized in terms of patterns of signature change. ERTS MSS digital data were used to discriminate vegetation classes at the association level and at the alliance level when image contrasts were high or low, respectively. An imagery comparison technique was developed to test image complexity and image groupability. In two stage sampling of vegetation types, ERTS plus high altitude photos were highly satisfactory for estimating kind and extent of types present, and for providing a mapping base.

N76-11523*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
ANALYSIS OF RIVER MEANDERS FROM ERTS-1 IMAGERY Final Report, 29 Aug. 1972 - 14 Jul. 1973
Robert N. Colwell, Gerald Schubert, and Richard Lingelfelter, Principal Investigators 14 Jul. 1973 118 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21827)
(E76-10025; NASA-CR-145418) Avail: NTIS HC $5.50 CSCL 08H

There are no author-identified significant results in this report.

N76-11524*# South Dakota State Univ., Brookings. Remote Sensing Inst.
INVESTIGATION OF REMOTE SENSING TECHNIQUES AS INPUTS TO OPERATIONAL RESOURCE MANAGEMENT MODELS Interim Report, 11 Jun. - 10 Sep. 1975
Fred A. Schmer, Principal Investigator and Robert E. Isakson Sep. 1975 16 p ref Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20982)
(E76-10026; NASA-CR-145419; RSI-SDSU-75-08) Avail: NTIS HC $3.50 CSCL 08F

There are no author-identified significant results in this report.

N76-11525*# Colorado School of Mines, Golden. Dept. of Geology.
EVALUATION OF SKYLAB PHOTOGRAPHS OVER CENTRAL COLORADO FOR LOCATING INDICATORS OF MINERALIZATION
Keenan Lee, Principal Investigator and Gary L. Prost Jun. 1975 121 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13394)
(E76-10027; NASA-CR-144513; Rept-75-3) Avail: NTIS HC $5.50 CSCL 05B

The author has identified the following significant results. Skylab S190A and S190B photographs over central Colorado, covering approximately 47,000 sq kilometers of the Rocky Mts, were analyzed to determine which features associated with known mining districts are recogniziable on space images. Results of this analysis indicate that visible features associated with mineralization include high densities of linears, complex linear intersections, red ocher, and light color (alteration) anomalies, and perhaps vegetation patterns unique to mineralized areas. Skylab photos (taken 11 June and 4 August 1973) were also studied in an attempt to locate the features indicative of mineralization. Two target areas were chosen where several favorable features coincided; a primary study area (32.5 sq km) was established at Weston Pass, and a secondary area (130 sq km) was located at Dome Rock. Ground truth, obtained at the primary target area by geologic mapping at a scale of 1:12000, was used to identify the features seen on the photography and to evaluate orbital imagery as a tool in mineral exploration. Linear features may be attributed to aligned or straight streams, ridges, vegetation, and cultural features such as roads, fences, powerlines, and contrails, as well as geologic features including faults, joints, shear zones, dikes, contacts, and paleovalleys. Red ocher colors result from sedimentary red-beds, microcline-rich crystalline rock or grus, iron oxide alteration, or combinations of these. Vegetation was influenced most by moisture, slope steepness, and seasons.

N76-11526*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.
APPLICATION OF LANDSAT SYSTEM FOR IMPROVING METHODOLOGY FOR INVENTORY AND CLASSIFICATION OF WETLANDS Progress Report, 4 Apr. - 3 Jul. 1975
David S. Gilmer, Principal Investigator and Edgar A. Work, Jr. 4 Oct. 1975 3 p ERTS
(NASA Order S-54049-A)
(E76-10028; NASA-CR-145420) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-11527*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO USING ERTS-1 DATA Final Report, 30 Jun. 1972 - 1 Aug. 1974
Daniel H. Knepper, Principal Investigator Aug. 1974 224 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dokato Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21778)
(E76-10029; NASA-CR-145421; Rept-75-1) Avail: NTIS HC $7.75 CSCL 08G

The author has identified the following significant results. Most of the geologic information in ERTS-1 imagery can be extracted from bulk processed black and white transparencies by a skilled interpreter using standard photogeologic techniques. In central and western Colorado, the detectability of lithologic contacts on ERTS-1 imagery is closely related to the time of year the imagery was acquired. Geologic structures are the most

readily extractable type of geologic information contained in ERTS images. Major tectonic features and associated minor structures can be rapidly mapped, allowing the geologic setting of a large region to be quickly accessed. Trends of geologic structures in younger sedimentary appear to strongly parallel linear trends in older metamorphic and igneous basement terrain. Linears and color anomalies mapped from ERTS imagery are closely related to loci of known mineralization in the Colorado mineral belt.

N76-11528*# Army Engineer District, San Francisco, Calif.
CALIFORNIA COASTAL PROCESSES STUDY: SKYLAB Final Report, May 1973 - Jun. 1975
Douglas M. Pirie and David D. Steller, Principal Investigators (Geosource Inc., Long Beach, Calif.) Jun. 1975 74 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order A-85918-A)
(E76-10030; NASA-CR-144489) Avail: NTIS HC $4.50 CSCL 08J

The author has identified the following significant results. In San Pablo Bay, the patterns of dredged sediment discharges were plotted over a three month period. It was found that lithogenous particles, kept in suspension by the fresh water from the Sacramento-San Joaquin, were transported downstream to the estuarine area at varying rates depending on the river discharge level. Skylab collected California coastal imagery at limited times and not at constant intervals. Resolution, however, helped compensate for lack of coverage. Increased spatial and spectral resolution provided details not possible utilizing Landsat imagery. The S-192 data was reformatted; band by band image density stretching was utilized to enhance sediment discharge patterns entrainment, boundaries, and eddys. The 26 January 1974 Skylab 4 imagery of San Francisco Bay was taken during an exceptionally high fresh water and suspended sediment discharge period. A three pronged surface sediment pattern was visible where the Sacramento-San Joaquin Rivers entered San Pablo Bay through Carquinez Strait.

N76-11529*# New Mexico State Bureau of Mines and Mineral Resources, Socorro.
EARTH RESOURCES EVALUATION FOR NEW MEXICO BY LANDSAT-2 Progress Report, 1-31 Aug. 1975
Karl Vonder Linden, Principal Investigator, Sandra C. Feldman, Michael H. Inglis, Frank E. Kottlowski, and David E. Tabet 31 Aug. 1975 5 p ERTS
(Contract NAS5-20916)
(E76-10031; NASA-CR-145423) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. The Middle Rio Grande project has not yet progressed to the point where mineral exploration sites can be chosen; however, there does appear to be some correlation between the known structure and mineral deposits and the LANDSAT lineament map. A circular feature identified in the southern Magdalena Mountains on LANDSAT-1 imagery agrees well with the location of a newly proposed caldron complex. Several recognized and unrecognized circular features were identified on imagery of the Mogollon-Datil volcanic field. A check of aeromagnetic maps for New Mexico found that the circular features on the LANDSAT imagery showed up as areas of generally high magnetic intensity.

N76-11530*# Agricultural Research Service, Weslaco, Tex.
SOIL, WATER, AND VEGETATION CONDITIONS IN SOUTH TEXAS Quarterly Progress Report, 13 Jul. - 13 Oct. 1975
Craig L. Wiegand, Harold W. Gausman, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Oct. 1975 23 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-53876-AG)
(E76-10032; NASA-CR-145424) Avail: NTIS HC $3.50 CSCL 08F

The author has identified the following significant results. To distinguish dead from live vegetation, spectrophotometrically measured infinite reflectance of dead and live corn (Zea mays L.) leaves were compared over the 0.5 to 2.5 micron waveband. Dead leaf reflectance was reached over the entire 0.5 to 2.5 micron waveband by stacking only two to three leaves. Live leaf reflectance was attained by stacking two leaves for the 0.5 to 0.75 micron waveband (chlorophyll absorption region), eight leaves for the 0.75 to 1.35 micron waveband (near infrared region), and three leaves for the 1.35 to 2.5 micron waveband (water absorption region). LANDSAT-1 MSS digital data for 11 December 1973 overpass were used to estimate the sugar cane acreage in Hidalgo County. The computer aided estimate was 22,100 acres compared with the Texas Crop and Livestock Reporting Service estimate of 20,500 acres for the 1973-'74 crop year. Although there were errors of omission from harvested fields that were identified as bare soil and some citrus and native vegetation that were mistakenly identified as sugar cane, the mapped location of sugar cane fields in the county compared favorably with their location on the thematic map generated by the computer.

N76-11531*# Purdue Univ., Lafayette, Ind.
CROP IDENTIFICATION AND ACREAGE ESTIMATION OVER LARGE GEOGRAPHIC AREAS USING LANDSAT MSS DATA Quarterly Progress Report, 1 Jul. - 30 Sep. 1975
Marvin E. Bauer, Principal Investigator 30 Sep. 1975 2 p ERTS
(Contract NAS5-20793)
(E76-10033; NASA-CR-145426) Avail: NTIS HC $3.50 CSCL 08F

There are no author-identified significant results in this report.

N76-11532*# Rockwell International Science Center, Thousand Oaks, Calif.
ANALYSIS OF TECTONIC FEATURES IN US SOUTHWEST FROM SKYLAB PHOTOGRAPHS Final Report, 14 May 1973 - 30 Jun. 1975
Monem Abdel-Gawad, Principal Investigator and Linda Tubbesing 15 Sep. 1975 95 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contracts NAS2-7523; NAS9-14440)
(E76-10034; NASA-CR-144464; SC5007.16FR) Avail: NTIS HC $5.00 CSCL 08B

The author has identified the following significant results. Skylab photographs were utilized to study faults and tectonic lines in selected areas of the U.S. Southwest. Emphasis was on elements of the Texas Zone in the Mojave Desert and the tectonic intersection in southern Nevada. Transverse faults believed to represent the continuation of the Texas Zone were found to be anomalous in strike. This suggests that the Mojave Desert block was rotated counterclockwise as a unit with the Sierra Nevada. Left-lateral strike-slip faults in Lake Mead area are interpreted as elements of the Wasatch tectonic zone; their anomalous trend indicates that the Lake Mead area has rotated clockwise with the Colorado Plateau. A tectonic model relating major fault zones to fragmentation and rotation of crustal blocks was developed. Detailed correlation of the high resolution S190B metric camera photographs with U-2 photographs and geologic maps demonstrates the feasibility of utilizing S190B photographs for the identification of geomorphic features associated with recent and active faults and for the assessment of seismic hazards.

N76-11533*# Kennecott Exploration, Inc., Salt Lake City, Utah.
RESEARCH ON RECOGNITION OF THE GEOLOGIC FRAMEWORK OF PORPHYRY COPPER DEPOSITS ON ERTS-1 IMAGERY Final Report
John C. Wilson, Principal Investigator Sep. 1975 225 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21769)
(E76-10035; NASA-CR-145425) Avail: NTIS HC $7.75 CSCL 08G

The author has identified the following significant results. Many new linear and circular features were found. These features prompted novel tectonic classification and analysis especially in the Ray and Ely areas. Tectonic analyses of the Ok Tedi, Tanacross, and Silvertone areas follow conventional interpretations. Circular

features are mapped in many cases and are interpreted as exposed or covered intrusive centers. The small circular features reported in the Ok Tedi test area are valid and useful correlations with tertiary intrusion and volcanism in this remote part of New Guinea. Several major faults of regional dimensions, such as the Denali fault in Alaska and the Colorado mineral belt structures in Colorado are detected in the imagery. Many more faults and regional structures are found in the imagery than exist on present maps.

N76-11534*# Pennsylvania Univ., Philadelphia. Museum Applied Science Center for Archaeology.

DETECTION OF CROP MARK CONTRAST FOR ARCHAEOLOGICAL SURVEYS Progress Report

Bruce Bevan, Principal Investigator 8 Oct. 1975 3 p ERTS (Contract NAS5-20792)

(E76-10036; NASA-CR-145427; QPR-3) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-11535*# Joint Publications Research Service, Arlington, Va.

SALYUT-3 PHOTOGRAPHS THE EARTH

V. D. Bolshakov and N. P. Lavrova Washington NASA Oct. 1975 7 p Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 3, May - Jun. 1975 p 8-11 Sponsored by NASA

(NASA-TT-F-16587) Avail: NTIS HC $3.50 CSCL 14E

Photographs taken from the manned orbital station Salyut-3 on 17 July 1974 are shown. Especially prominent in the photographs is the region of the Volga River and the Eastern part of the Atlantic Ocean. Spectral curves are included for two different types of photographic film. Author

N76-11536*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE ERTS-1 INVESTIGATION (ER-600). VOLUME 3: ERTS-1 FOREST ANALYSIS Technical Report, Jul. 1972 - Jun. 1973

R. Bryan Erb Jun. 1974 105 p refs Original contains color illustrations

(NASA-TM-X-58119; JSC-08458-Vol-3) Avail: NTIS HC $5.50 CSCL 02F

The Forest Analysis Team of the Lyndon B. Johnson Space Center Earth Observations Division conducted a year's investigation of LANDSAT 1 multispectral data to determine the size of forest features that could be detected and to determine the suitability for making forest classification maps. The Sam Houston National Forest of Texas was used as the test site. Using conventional interpretation and computer aided techniques, the team was able to differentiate up to 14 classes of forest features to an accuracy ranging between 55 and 84 percent. Author

N76-11537*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE ERTS-1 INVESTIGATION (ER-600). VOLUME 4: ERTS-1 RANGE ANALYSIS Technical Report, Jul. 1972 - Jun. 1973

R. Bryan Erb Jun. 1974 173 p refs Original contains color illustrations

(NASA-TM-X-58120; JSC-08459-Vol-4) Avail: NTIS HC $6.75 CSCL 08F

The Range Analysis Team conducted an investigation to determine the utility of using LANDSAT 1 data for mapping vegetation-type information on range and related grazing lands. Two study areas within the Houston Area Test Site (HATS) were mapped to the highest classification level possible using manual image interpretation and computer aided classification techniques. Rangeland was distinguished from nonrangeland (water, urban area, and cropland) and was further classified as woodland versus nonwoodland. Finer classification of coastal features was attempted with some success in differentiating the lowland zone from the drier upland zone. Computer aided temporal analysis techniques enhanced discrimination among nearly all the vegetation types found in this investigation. Author

N76-11538*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE ERTS-1 INVESTIGATION (ER-600). VOLUME 6: ERTS-1 SIGNATURE EXTENSION ANALYSIS, JULY 1972 - JUNE 1973

R. Bryan Erb Jun. 1974 88 p ref Original contains color illustrations.

(NASA-TM-X-58122; JSC-08461-Vol-6) Avail: NTIS HC $5.00 CSCL 05B

Feature classification, spatially and temporally, was extended over the Houston test site area. The Earth Resources Technology Satellite (ERTS-1) multispectral scanner data from August, September, and October 1972, of five widely separated lakes were used as statistical training fields and test sites. Short term temporal (same day to 36 days) and moderately long term spatial (within and between three ERTS multispectral scanner frames) signature extensions have been verified with respect to large relatively homogeneous features. The most significant feature dependent variable affecting spatial and short term extension was water turbidity. Long term signature extension will require a model to compensate or modify the ERTS-1 multispectral scanner data for significant sun angle changes. The presence of atmospheric haze changed the absolute signature but always by approximately the same amount so that the measured water signature was always the same. The normally occurring variations in atmospheric haze conditions had no major effect on the water signatures in this study. Author

N76-11539*# Business and Technological Systems, Inc., Seabrook, Md.

NOISE CHARACTERISTICS OF THE SKYLAB S-193 ALTIMETER ALTITUDE MEASUREMENTS Final Report, Nov. 1974 - Aug. 1975

William E. Hatch Nov. 1975 212 p refs

(Contract NAS6-2631)

(NASA-CR-141403; BTS-TR-75-23) Avail: NTIS HC $7.75 CSCL 14B

The statistical characteristics of the SKYLAB S-193 altimeter altitude noise are considered. These results are reported in a concise format for use and analysis by the scientific community. In most instances the results have been grouped according to satellite pointing so that the effects of pointing on the statistical characteristics can be readily seen. The altimeter measurements and the processing techniques are described. The mathematical descriptions of the computer programs used for these results are included. Author

N76-11540*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

MACHINE PROCESSING OF S-192 AND SUPPORTING AIRCRAFT DATA: STUDIES OF ATMOSPHERIC EFFECTS, AGRICULTURAL CLASSIFICATIONS, AND LAND RESOURCE MAPPING Final Report, 8 Mar. 1973 - 30 Aug. 1975

F. Thomson Aug. 1975 92 p refs

(Contract NAS9-13272)

(NASA-CR-144503; ERIM-101700-27-F) Avail: NTIS HC $5.00 CSCL 08B

Two tasks of machine processing of S-192 multispectral scanner data are reviewed. In the first task, the effects of changing atmospheric and base altitude on the ability to machine-classify agricultural crops were investigated. A classifier and atmospheric effects simulation model was devised and its accuracy verified by comparison of its predicted results with S-192 processed results. In the second task, land resource maps of a mountainous area near Cripple Creek, Colorado were prepared from S-192 data collected on 4 August 1973. Author

N76-11541*# Marine Environmental Sciences Consortium, Dauphin Island, Ala.

CHARACTERIZATION OF USERS OF REMOTELY-SENSED DATA IN THE ALABAMA COASTAL ZONE

Barry A. Vittor, ed. Mar. 1975 161 p refs

(Contract NAS8-30810)

(NASA-CR-144058) Avail: NTIS HC $6.75 CSCL 08J

Federal, State, local, universities and private companies were polled to determine their needs for remote sensing data. A total of 62 users were polled. Poll results are given in tables. A comprehensive research program was developed to satisfy user needs, and is examined for the disciplines of Geology, Water

Resources, Archaeology, Geography, and Conservation. An investigation of silt plume discharge from Mobile Bay is also examined. Sample poll forms used in the surveys are shown. J.R.T.

N76-11542*# Kanner (Leo) Associates, Redwood City, Calif.
SIDE-LOOKING RADAR IMAGERY ASSEMBLY TOROS FOR STUDYING ICE DRIFT
Yu. A. Gorbunov and S. M. Losev Washington NASA Nov. 1975 17 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauch.-Issled. (Leningrad), v. 136, 1974 p 153-162
(Contract NASw-2790)
(NASA-TT-F-16664) Avail: NTIS HC $3.50 CSCL 08L

A method is proposed for elimination of scale distortions in side-looking radar images of ice cover, and distortions due to variations in aircraft drift angle and speed. The method consists essentially of graphical determination of errors and introduction of the appropriate corrections in transfer of data from the radar image to the working topographic map and then to the final map. Author

N76-11543*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONITORING WATER QUALITY FROM LANDSAT
John L. Barker Jul. 1975 40 p
(NASA-TM-X-71006; X-923-75-190) Avail: NTIS HC $4.00 CSCL 13B

Water quality monitoring possibilities from LANDSAT were demonstrated both for direct readings of reflectances from the water and indirect monitoring of changes in use of land surrounding Swift Creek Reservoir in a joint project with the Virginia State Water Control Board and NASA. Film products were shown to have insufficient resolution and all work was done by digitally processing computer compatible tapes. Land cover maps of the 18,000 hectare Swift Creek Reservoir watershed, prepared for two dates in 1974, are shown. A significant decrease in the pine cover was observed in a 740 hectare construction site within the watershed. A measure of the accuracy of classification was obtained by comparing the LANDSAT results with visual classification at five sites on a U-2 photograph. Such changes in land cover can alert personnel to watch for potential changes in water quality. Author

N76-11544*# Department of Energy, Mines and Resources, Ottawa (Ontario). Surveys and Mapping Branch.
INVESTIGATION OF SELECTED IMAGERY FROM SKYLAB/EREP S190 SYSTEM FOR MEDIUM AND SMALL SCALE MAPPING Final Report, Apr. 1971 - Sep. 1975
R. A. Stewart Sep. 1975 171 p
(NASA-CR-144542) Avail: NTIS HC $6.75 CSCL 08I

Satellite photography provided by the Skylab mission was investigated as a tool in planimetric mapping at medium and small scales over land surface in Canada. The main interest involved the potential usage of Skylab imagery for new and revision line mapping, photomapping possibilities, and the application of this photography as control for conventional high altitude aerial surveys. The results of six independent investigations clearly indicate that certain selected sets of this photography are adequate for planimetric mapping purposes at scales of 1:250,000 and smaller. In limited cases, the NATO planimetric accuracy requirements for Class B 1:50,000 scale mapping were also achieved. Of the S190A photography system, the camera containing the Pan X Aerial Black and White film offers the greatest potential to mapping at small scales. However, the S190B system continually proved to offer more versatility throughout the entire investigation. Y.J.A.

N76-11545*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE IMPACT OF EARTH RESOURCES EXPLORATION FROM SPACE
William Nordberg Sep. 1975 13 p Presented at 31st Nobel Symp. on The Impact of Space Science on Mankind, Spatind, Norway, 8-12 Sep. 1975
(NASA-TM-X-71010; X-900-75-250) Avail: NTIS HC $3.50 CSCL 08G

The use of Earth Resources Technology Satellites in solving global problems is examined. Topics discussed are: (1) management of food, water, and fiber resources; (2) exploration and management of energy and mineral resources; (3) protection of the environment; (4) protection of life and property; and (5) improvements in shipping and navigation. J.R.T.

N76-11546*# South Dakota State Univ., Brookings. Remote Sensing Inst.
AERIAL THERMAL SCANNER DATA FOR MONITORING ROOFTOP TEMPERATURES
J. Bjorkland, F. A. Schmer, and R. E. Isakson Nov. 1975 25 p Prepared in cooperation with Central Telephone and Utilities Corp., Lincoln, Nebr.
(Grant NGL-42-003-007)
(NASA-CR-145747; SDSU-RSI-75-11) Avail: NTIS HC $3.50 CSCL 20F

Four Nebraska communities and one South Dakota community were surveyed. Thermal scanner data were converted to a film format and the resultant imagery was successfully employed to monitor rooftop temperatures. The program places emphasis on heat losses resulting from inadequate home insulation, offers CENGAS customers the opportunity to observe a thermogram of their rooftop, and assists homeowners in evaluating insulation needs. Author

N76-11547*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
REMOTE SENSING IN MICHIGAN FOR LAND RESOURCE MANAGEMENT Annual Report, 1 Jun. 1974 - 31 May 1975
D. S. Lowe, L. B. Istvan, N. E. G. Roller, A. N. Sellman, and T. W. Wagner Sep. 1975 77 p refs
(Grant NGR-23-005-552)
(NASA-CR-145538; ERIM-193400-9-p) Avail: NTIS HC $4.75 CSCL 08B

The utilization of NASA earth resource survey technology as an important aid in the solution of current problems in resource management and environmental protection in Michigan is discussed. Remote sensing techniques to aid Michigan government agencies were used to achieve the following results: (1) provide data on Great Lakes beach recession rates to establish shoreline zoning ordinances; (2) supply technical justification for public acquisition of land to establish the St. John's Marshland Recreation Area; (3) establish economical and effective methods for performing a statewide wetlands survey; (4) accomplish a variety of regional resource management actions in the Upper Peninsula; and (5) demonstrate improved soil survey methods. The project disseminated information on remote sensing technology and provided advice and assistance to a number of users in Michigan. Author

N76-11548*# Pan American Univ., Edinburg, Tex.
FURTHER TESTS OF PLANT CANOPY REFLECTANCE MODELS AND INVESTIGATION OF NON-LAMBERTIAN PROPERTIES OF PLANT CANOPIES Final Technical Report, 1 Sep. 1974 - 31 Aug. 1975
E. W. LeMaster Nov. 1975 64 p refs
(Contract NsG-9015)
(NASA-CR-145615) Avail: NTIS HC $4.50 CSCL 02C

The experimental bidirectional reflectance of cotton is presented and compared to the Suits vegetation model. Some wheat reflectance data are presented for a Mexican dwarf wheat. The general results are that the exchange of source position and detector position gives the same reflectance measurement if the irradiance is purely specular. This agrees with Suites. The reflectance versus sun angle and reflectance versus detector angle do not agree with the Suits predictions. There is qualitative agreement between the Suits model and reflectance versus wavelength, but quantitative agreement has not been observed. Reflectance of a vegetation canopy with detector azimuth shows a change of 10 to 40% for even sun angles near zenith, so it seems advisable to include azimuthal angles into models of vegetation. Author

N76-11549*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RESULTS OF PHASE ONE OF LAND USE INFORMATION DELPHI STUDY
Charles K. Paul and Albert J. Landini 1 May 1975 36 p
(Contract NAS7-100)

(NASA-CR-145574; JPL-SP-43-22) Avail: NTIS HC $4.00 CSCL 08B

The Land Use Management Information System (LUMIS) is being developed for the city portion of the Santa Monica mountains. LUMIS incorporates data developed from maps and aerial photos as well as traditional land based data associated with routine city and county record keeping activities and traditional census data. To achieve the merging of natural resource data with governmental data LUMIS is being designed in accordance with restrictions associated with two other land use information systems currently being constructed by Los Angeles city staff. The two city systems are LUPAMS (Land Use Planning and Management System) which is based on data recorded by the County Assessor's office for each individual parcel of land in the city, and Geo-BEDS, a geographically based environmental data system. Author

N76-11550# Army Engineer Topographic Labs., Fort Belvoir, Va.
SINGLE PHOTO ANALYSIS OF SAMPLED AERIAL IMAGERY
Michael A. Crombie, Philip G. Lem, and Thomas A. Hay Aug. 1974 51 p
(DA Proj. 4A7-62707-D-853)
(AD-A012176; ETL-RN-74-10) Avail: NTIS CSCL 08/2

Three single photo analyses of aerial photography using digital techniques are presented. A statistical description of thirty scenes taken from two stereo models is presented with a preliminary matching analysis using correlation procedures and a preliminary compaction analysis using Fourier techniques. Preliminary results indicate that image compaction using Fourier techniques is feasible and promising. Several useful properties of image matching were revealed in the analysis. GRA

N76-11551# Rhode Island Univ., Kingston. Dept. of Resources Economics.
OFFSHORE PETROLEUM AND NEW ENGLAND: A STUDY OF THE REGIONAL ECONOMIC CONSEQUENCES OF POTENTIAL OFFSHORE OIL AND GAS DEVELOPMENT
Thomas A. Grigalunas 1975 123 p refs
(Grant NOAA-04-3-158-3)
(COM-75-10717/7; Marine-TR-39; NOAA-75051603) Avail: NTIS HC $5.50 CSCL 08I

Direct and secondary impacts on New England of alternative potential offshore oil and gas developments and possible petroleum refinery activity within the region are examined. A number of specific Georges Bank oil and gas and petroleum refinery scenarios are postulated. For each alternative set of developments, estimates are made of their effects on total earnings, income, employment, and other socio-economic indicators. An estimate is provided of the possible direct and secondary impacts of alternative petroleum developments on broad industrial sectors of the regional economy. GRA

N76-11552# Pennsylvania Dept. of Environmental Resources, Harrisburg. Dept. of Environmental Resources.
USE OF PHOTO INTERPRETATION AND GEOLOGICAL DATA IN THE IDENTIFICATION OF SURFACE DAMAGE AND SUBSIDENCE Final Report, Nov. 1973 - Apr. 1975
Apr. 1975 246 p refs Prepared in cooperation with Earth Satellite Corp., Washington, D. C.
(PB-242468/7; ARC-73-111-2554) Avail: NTIS HC $8.00 CSCL 08I

Multi-sensor, multi-level remote sensing was examined for utility in detecting and delineating the surface expression of mine subsidence in the northern anthracite coal field of Pennsylvania. The objectives were to determine areas of potential subsidence so they can be considered in future planning and zoning processes. In this evaluation a variety of data were examined including ERTS imagery, SLAR imagery, color and color infrared photography of a number of scales, panchromatic photography acquired during the last 30 years, and spectro radiometric and thermal infrared scanner data. Maps were prepared showing geological lineaments and areas of mine subsidence were produced. GRA

N76-11553# Texas Univ., Austin. Div. of Natural Resources and Environment.
ESTABLISHMENT OF OPERATIONAL GUIDELINES FOR TEXAS COASTAL ZONE MANAGEMENT. ECONOMICS AND LAND USE: TECHNICAL ASSESSMENT OF ENVIRONMENTAL POLICY IMPACTS IN THE CORPUS CHRISTI AREA OF TEXAS Final Report, 1 Jun. 1972 - 31 May 1974
Kingsley E. Haynes and Jared E. Hazleton 31 May 1974 436 p
(Grant NSF GI-34870)
(PB-242608/8; NSF/RA/E-74-051) Avail: NTIS HC $11.75 CSCL 13B

The overall goal of the project reported on is to develop and test a methodology for assessing the economic and environmental impacts of alternative public policies for management of coastal zone environmental resources. The objectives of the task force established to assist in this project were twofold: (1) to develop and evaluate input/output and demographic models to project under varying assumptions the level of economic activity by industrial sector and the expected level of population in the coastal bend region; and (2) to develop and assess a land use model to spatially allocate households and industry within the study region. Author

N76-11485* Woods Hole Oceanographic Institution, Mass.
COMMENT ON SATELLITE ALTIMETER DATA
Carl Bowin *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 38 ref (For availability see N76-11482 02-42) CSCL 09F

N76-11495* Battelle Columbus Labs., Ohio.
CIVIL AND SCIENTIFIC APPLICATIONS OF THE GEOID
A. George Mourad *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 79-84 (For availability see N76-11482 02-42) CSCL 08B

N76-11511 Joint Publications Research Service, Arlington, Va.
GEOGRAPHIC PROBLEMS AND THE POSSIBILITIES OF THEIR SOLUTION BY AEROSPACE METHODS
S. V. Zonn *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 16-23 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 8 p (For availability see N76-11509 02-42)

N76-11512 Joint Publications Research Service, Arlington, Va.
PRINCIPLES AND METHODS FOR STUDYING FORESTS FROM SPACE
A. S. Isayev and D. M. Kireyev *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 24-29 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 6 p (For availability see N76-11509 02-42)

N76-11513 Joint Publications Research Service, Arlington, Va.
PROBLEMS IN REMOTE SENSING OF LAND RESOURCES AND AGRICULTURAL CROPS
G. S. Yelesin *In its* Exploration of Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 30-35 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 6 p (For availability see N76-11509 02-42)

N76-11515 Joint Publications Research Service, Arlington, Va.
USE OF MATERIALS FROM SPACE SURVEY FOR COMPILING AND REVISING GENERAL GEOGRAPHIC AND SPECIAL MAPS
Yu. G. Kelner and G. N. Romankevich *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 49-54 Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 6 p (For availability see N76-11509 02-42)

N76-11516 Joint Publications Research Service, Arlington, Va.
USE OF MULTIZONAL SPACE SURVEYS IN GEOGRAPHIC RESEARCH AND SPECIAL MAPPING
V. I. Kravtsova *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 55-76 refs Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 22 p (For availability see N76-11509 02-42)

N76-11648 Food and Agriculture Organization of the United Nations, Rome (Italy).
MEASUREMENTS AND CALCULATIONS OF SOLAR AND NET RADIATION
D. Rijks *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 56-69 refs (For availability see N76-11640 02-47)
Copyright.

N76-11655 Food and Agriculture Organization of the United Nations, Rome (Italy).
MEASUREMENTS OF EVAPOTRANSPIRATION
D. Rijks *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 105-114 refs (For availability see N76-11640 02-47)
Copyright.

N76-11656 Strathclyde Univ., Glasgow (Scotland). Dept. of Applied Physics.
POTENTIAL EVAPOTRANSPIRATION CALCULATIONS AND THEIR USE IN IRRIGATION
T. Woodhead *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 115-119 refs (For availability see N76-11640 02-47)
Copyright.

N76-11657 Field Science Office for Africa, Nairobi (Kenya).
NATURE CONSERVATION AND WATER RESOURCES: ASPECTS OF THE HIGHLANDS OF EASTERN AFRICA
Kai Curry-Lindahl *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 120-131 refs (For availability see N76-11640 02-47)
Copyright.

N76-11658 East African Agricultural and Forestry Research Organization, Muguga (Kenya).
THE WATER BALANCE OF CATCHMENTS IN THE HIGHLANDS OF KENYA
K. A. Edwards *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 132-151 refs (For availability see N76-11640 02-47)
Copyright.

N76-11660 National Agricultural Research Station, Kitale (Kenya).
MAIZE PRODUCTION TRENDS IN KENYA AND THE INFLUENCE OF SEASONAL RAINFALL VARIATIONS ON OUTPUT
A. Y. Allan *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 161-168 refs Sponsored by Overseas Develop. Admin. (For availability see N76-11640 02-47)
Copyright.

N76-11661 National Agricultural Research Station, Kitale (Kenya).
SOIL PHYSICAL CONDITIONS UNDER MAIZE
P. J. M. Cooper *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 169-186 refs Sponsored by Overseas Develop. Admin. (For availability see N76-11640 02-47)
Copyright.

N76-11662 National Agricultural Research Station, Kitale (Kenya).
PRELIMINARY FINDINGS OF A STUDY OF THE GROWTH OF MAIZE IN KENYA
R. Law *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 187-196 refs Sponsored by Overseas Develop. Admin. (For availability see N76-11640 02-47)
Copyright.

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-11554*+ National Aeronautics and Space Administration, Washington, D.C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Aug. 1975 109 p refs
(NASA-SP-7043(05)) Avail: NTIS HC $4.00 CSCL 10A

This bibliography lists 337 reports, articles, and other documents introduced into the NASA scientific and technical information system from January 1, 1975 through March 31, 1975. Author

N76-11555+ Wetenschappelijk en Technisch Documentatie- en Informatiecentrum voor de Krijgsmacht, The Hague (Netherlands).
FUEL CELLS: BIBLIOGRAPHY, 1963 - 1974
D. J. J. S. M. Moreau, comp. 1974 55 p refs Partly in ENGLISH, GERMAN, DUTCH, and FRENCH
(TDCK-65924) Avail: NTIS HC $4.50

A bibliography listing 107 references on fuel cells covering literature present at the TDCK in the Hague is given. Subjects covered are electrode reactions, reaction kinetics, fuel cell electrodes for hydrogen oxygen fuel cells and other systems, and applications to power generation plants and space uses and also electrical propulsion. ESA

N76-11556# Committee on Ways and Means (U. S. House).
THE ENERGY CRISIS AND PROPOSED SOLUTIONS, PART 1
Washington GPO 1975 569 p refs Panel discussions before Comm. on Ways and Means, 94th Congr., 1st Sess., 3-7 Mar., 10-14 Mar., and 17 Mar. 1975
(GPO-49-192) Avail: Comm. on Ways and Means

Alternatives for reducing America's vulnerability to economic disruption as a result of foreign oil dependence and energy shortages are discussed. Energy conservation measures, import quotas, strategic reserves, and oil allocation programs are considered. Data are also given on oil tax policies and capital incentives. E.H.W.

N76-11557*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
PERFORMANCE OF A SOLAR-THERMAL COLLECTOR
W. H. Higa 1 Nov. 1975 21 p refs
(Contract NAS7-100)
(NASA-CR-145623; JPL-TM-33-748) Avail: NTIS HC $3.50 CSCL 10A

Possible means of achieving the technology required for field application of solar thermal power systems are discussed. Simplifications in construction techniques as well as in measurement techniques for parabolic trough collectors are described. Actual measurement data is also given. Author

N76-11558*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
TERRESTRIAL SOLAR THERMIONIC ENERGY CONVERSION SYSTEMS CONCEPT
K. Shimada and M. Swerdling 1 Nov. 1975 29 p refs
(Contract NAS7-100)
(NASA-CR-145622; JPL-TM-33-744) Avail: NTIS HC $4.00 CSCL 10A

Results obtained from studies of a (1) solar concentrator, (2) solar energy receiver - thermionic converter system, and (3) solar thermionic topping system are described. Peripheral subsystems, which are required for any solar energy conversion system, are also discussed. Author

N76-11559# Joint Publications Research Service, Arlington, Va.

TURBINES FOR NUCLEAR POWER STATIONS

28 Oct. 1975 31 p refs Transl. into ENGLISH from Teploenerg. (Moscow), v. 22, no. 8, 1975 p 2-12

(JPRS-66022) Avail: NTIS HC $4.00

Low speed turbines for nuclear power stations and the PT-136.165-130.15 turbine with industrial and heating steam bleeders are described. Author

N76-11560# Research Inst. of National Defence, Stockholm (Sweden).

TEST ON SEALED Ni/Cd CELLS FOR SATELLITE USE

B. Hallgren and P. E. Samsioe Paris ESA Aug. 1975 181 p (Contract ESTEC-887/69-HP)

(ESA-CR-576) Avail: NTIS HC $7.50

The performance of 6 Ah Ni/Cd cells manufactured for space application was evaluated. Capacity and charge/discharge voltages were determined as a function of operating temperature, charge current, and discharge current. A short study of charge efficiency and overcharge at constant voltage completed the characterization of the cell. The lifetime of the cell was studied in low orbit-like cycling over a wide range of operating conditions. ESA

N76-11561# European Space Research and Technology Center, Noordwijk (Netherlands).

SOLAR CONSTANT, AM0 SPECTRAL IRRADIANCE AND SOLAR-CELL CALIBRATION

K. Bogus Paris ESA Jun. 1975 14 p refs

(ESA-TM-160-ESTEC) Avail: NTIS HC $3.50

Almost identical results have been obtained from Malta and JPL balloon flight solar cell calibrations, yet there was a significant difference in the value of the solar constant used in the two cases. This discrepancy (4.5%) suggests the existence of systematic errors. A review of the solar constant value and of the air mass zero (AM0) spectral irradiance curve shows that the discrepancy results from an underestimation of the solar energy in the 0.30 micrometer to 1.10 micrometer wavelength range. No systematic error has been detected in the integral value of the solar constant. Author (ESA)

N76-11562# European Space Agency, Paris (France).

FLAT SOLAR COLLECTORS: ENERGY BALANCE AND EFFICIENCY

Rainer Koehne Sep. 1975 43 p refs Transl. into ENGLISH of "Der flache Sonnenkollektor Energiebilanz u. Wirkungsgrad", DFVLR, Stuttgart Report DLR-FB-75-33, 7 Apr. 1975 Original German report available from DFVLR, Porz, West Ger. 17.70 DM

(ESA-TT-185; DLR-FB-75-33) Avail: NTIS HC $4.00

A theoretical model for the flat solar collector is described and the energy balance equations considering the heat losses by convection, conduction, and radiation are derived. Efficiencies of various collector types as functions of solar flux and ambient temperature are given in graph form and compared with each other. It is shown that for the latitudes discussed (Germany) the most suitable type of collector is the one with two cover plates, attaining an average efficiency of about 50%, precise value depending on desired collector temperature and, therefore, water temperature. Author (ESA)

N76-11563# Naval Postgraduate School, Monterey, Calif.

THERMOECONOMIC ANALYSIS OF ENVIRONMENTAL VAPOR POWER SYSTEM M.S. Thesis

Furman Ladow Sheppard, Jr. Jun. 1975 106 p refs

(AD-A012416) Avail: NTIS CSCL 13/1

A method is presented for determining the relationships between the costs and technical performance of environmental vapor power systems in a manner which permits fundamental design specifications to be made optimally with respect to overall system lifetime costs. Means of applying optimization techniques for large scale systems to the thermoeconomic analysis of environmental vapor power systems are described and demonstrated with a simplified sample model. A sequential unconstrained minimization algorithm is employed for overall system design optimization. GRA

N76-11564# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.

NICKEL HYDROGEN ENERGY STORAGE FOR SATELLITES Final Report Supplement, Dec. 1974 - Feb. 1975

E. Levy, Jr. and H. H. Rogers Nov. 1974 89 p

(Contract F33615-73-C-2064; AF Proj. 3145)

(AD-A012303; SCG-50124; AFAPL-TR-74-111-Suppl-1) Avail: NTIS CSCL 10/3

The purpose of this supplement is to report additional test data on Tyco 50 A-hr boilerplate cells, cycle and capacity test results on Eagle-Picher 20 A-hr prismatic cells and 50 A-hr pineapple-slice design boilerplate cells. Detailed test data are presented and interpreted in this report. An appendix which discusses selection of material for the nickel-hydrogen battery pressure vessel is also provided. GRA

N76-11565# Massachusetts Inst. of Tech., Cambridge. Energy Lab.

A REGIONALIZED ELECTRICITY MODEL Progress Report

Martin L. Baughman and Paul L. Joskow Dec. 1974 60 p refs

(Grant NSF SIA-73-07971-A02)

(PB-242216/0; MIT-EL-75-005; NSF/RA/N-74-203) Avail: NTIS HC $4.50 CSCL 05C

An engineering-econometric simulation model is designed to provide a quantitative understanding of the effect of a wide range of variables on electricity supply, demand, and electricity costs. Geographically, the model consists of nine regions corresponding to the nine census regions of the U.S. The variables considered are electricity demand; the capital and operating costs of different types of generating plant; fuel prices; and the shape of load curves. A change in any of these items may affect most features of the future evolution of fuels consumption and costs within the industry. Future modifications of the initial model will allow investigation of the effects of sulfur restrictions, nuclear growth constraints, peak load pricing, capital constraints, and breeder reactor availability. GRA

N76-11566# Illinois Univ., Urbana. Center for Advanced Computation.

ENERGY CONSERVATION THROUGH TAXATION Interim Research Report

Clark W. Bullard Jan. 1974 31 p refs

(Grant NSF GI-35179)

(PB-242620/3; UIUC-CAC-DN-74-95; NSF/RA/N-74-206) Avail: NTIS HC $4.00 CSCL 05A

The growth of energy productivity has slowed in recent years. This trend implies that energy demands will rise at increasing rates if economic growth is sustained. In turn, environmental, fiscal, and national security problems associated with growing energy demands may increase faster than the ability to cope with them. To provide incentives for increasing energy productivity, an energy conservation tax is proposed. A linear model is used to estimate the impacts of such a tax on prices of final products. It is shown that an ad valorem tax could be more regressive than a specific tax based on energy units. GRA

N76-11567# National Bureau of Standards, Washington, D.C. Office of Building Standards and Codes Services.

EMERGENCY WORKSHOP ON ENERGY CONSERVATION IN BUILDINGS. NATIONAL CONFERENCE OF STATES ON BUILDING CODES AND STANDARDS AND NATIONAL BUREAU OF STANDARDS JOINT EMERGENCY WORKSHOP ON ENERGY CONSERVATION IN BUILDINGS Final Report

Sandra A. Berry Jul. 1975 34 p Workshop held at Washington, D. C., 19 June. 1973

(COM-75-10766/4; NBS-TN-789-1) Avail: NTIS HC $4.00 HC also available from SOD as C13.46:789-1 CSCL 10A

This report contains the non-technical presentations given at the National Conference of States on Building Codes and Standard/National Bureau of Standards Joint Emergency Workshop on Energy Conservation in Buildings. Presentations included are those of other federal agencies, states, technical societies and industry organizations. GRA

N76-11568# Federal Energy Administration, Washington, D.C.

ELECTRICITY RATES AND THE ENERGY CRISIS: A

CONFERENCE REPORT
Aug. 1974 84 p refs Presented at the Elect. Rate Conf., Washington, D. C., 19 Jun. 1974
(PB-242474/5; FEA/G-75/96) Avail: NTIS HC $5.00 CSCL 10A

Economic problems in the electrical utilities industry are discussed. The papers contained in this volume represent a consensus at the first conference, held on June 19, 1974. Discussion centered on improvements in electrical utility rate structures to improve consumer equity, promote energy conservation, and provide revenues necessary for continued expansion of services. GRA

N76-11569# California Polytechnic State Univ., San Luis Obispo.
RESEARCH ON THE APPLICATION OF SOLAR ENERGY TO THE FOOD DRYING INDUSTRY Quarterly Progress Report, 1 Jan. - 31 Mar. 1975
Thomas Lukes 31 Mar. 1975 10 p
(Grant NSF ERT-74-19063)
(PB-242160/0; NSF/RA/N-75-032; QPR-1) Avail: NTIS HC $3.50 CSCL 10A

Very briefly summarized are procurement of materials and construction of a unit for drying various fruits and vegetables using combinations of solar energy and steam. GRA

N76-11570# Federal Energy Administration, Washington, D.C. Office of Energy Data Policy.
PROCEEDINGS OF THE NATIONAL ENERGY DATA WORKSHOP
Apr. 1975 261 p refs Workshop held at Lafayette, Ind., 30-31 Oct. 1974
(PB-241665/9; FEA/G-75/211R) Avail: NTIS HC $9.00 CSCL 10A

The proceedings of the National Energy Data Workshop cover the two day conference co-sponsored by the Federal Energy Administration and Purdue University. Presentations given at the conference by federal and state officials include; (1) Petroleum information systems; (2) Information for contingency planning; (3) Long range data programs; (4) FEA data programs in relation to the states; (5) Should the states be in the energy information business. GRA

N76-11571# Federal Energy Administration, Washington, D.C. Office of Energy Resource Development.
THE UTILITY OIL SAVINGS STUDY Final Report
Jan. 1975 36 p
(PB-242493/5; FEA/G-75/255) Avail: NTIS HC $4.00 CSCL 10A

This report includes an analysis of five measures to save oil in the utility sector and identifies the oil savings, associated costs, and constraints under alternative policy options. Particular emphasis is accorded to measuring the impact on the oil savings objective of those initiatives proposed by the President in the State of the Union Message. GRA

N76-11572# Resource Planning Associates, Inc., Cambridge, Mass.
ENERGY SUPPLY/DEMAND ALTERNATIVES FOR THE APPALACHIAN REGION, EXECUTIVE SUMMARY Final Report, Mar. - Dec. 1974
Mar. 1975 90 p Prepared in cooperation with Appalachian Regional Commission and NSF
(PB-242944/7; RA-74-18) Avail: NTIS HC $5.00 CSCL 10A

The report is presented in two parts: (1) A description of the development of an analytic methodology, emphasizing the way it was used to estimate regional energy supply/demand balances and impacts; and (2) the findings and policy implications for the Appalachian Region resulting from the analysis of seven national energy scenarios. The most important effects analyzed included end use consumption patterns; required energy sources (especially coal) and conversion facilities; and economic, social, and environmental impacts on Appalachia and its subregions. Author

N76-11573# McDonnell-Douglas Corp., Santa Monica, Calif.
HELIOSTAT MOUNT Final Invention Disclosure
Clarence R. Applebaugh 1975 6 p
(Grant NSF GI-39456)
(PB-242935/5) Avail: NTIS HC $3.50 CSCL 10B

This device is designed to support and move a large reflector in such a way that the reflection of the sun or other moving object is directed to a fixed target point located at any position in the hemisphere above the horizon. The device must have sufficient strength and rigidity to maintain the reflected image accurately on the target point under wind gust conditions. This device provides a stronger, more rigid design than present devices to maintain accurate positioning under wind loading. GRA

N76-11574# California Univ., Berkeley. Sanitary Engineering Research Lab.
SOLAR ENERGY FIXATION AND CONVERSION WITH ALGAL BACTERIAL SYSTEMS Semiannual Progress Report, 1 Jul. - 30 Sep. 1974
Moshe Uziel, William J. Oswald, and G. Golueke 4 Dec. 1974 18 p
(Grant NSF GI-39216)
(PB-242362/2; SERL-74-3;
NSF/RANN/SE/GI-39216/PR/74-3; NSF/RA/N-74-195)
Avail: NTIS HC $3.50 CSCL 13B

The overall objective of the study is to explore the feasibility of a process which is based on the utilization of algal-bacterial cultures integrated in such a manner that solar energy is 'fixed' into algal cellular material--material which in turn is converted to methane by way of anaerobic digestion. The process is coupled with waste-water treatment and nutrient recycle. An important specific objective is the assessment of the enonomic feasibility of the solar energy fixation-methane-production system in terms of generation of electricity through the combustion of the methane and of the recycling of the nutrients in waste water. A second important specific objective is an assessment of the comparative fermentability of several species of algae. GRA

N76-11575# Universal Oil Products Co., Des Plaines, Ill.
CARBONACEOUS CATALYSTS FOR H3PO4 FUEL CELLS Interim Report, Aug. 1974 - Feb. 1975
L. B. Welsh, G. L. Hervert, D. H. Spielberg, and K. J. Youtsey Mar. 1975 54 p refs
(Contract DAAK02-75-C-0011; DA Proj. 1G7-62708-AH-67)
(AD-A012283; IR-1) Avail: NTIS CSCL 10/2

UOP Kocite(R) materials are being evaluated as low cost air and/or fuel electrocatalysts in phosphoric acid electrolyte fuel cells. Kocite(R) materials are composite structures consisting of pyropolymers chemically bonded to refractory substrates. Fuel cell electrodes are fabricated and tested as anodes or cathodes in model fuel cells with conventional Pt fuel electrodes as counter electrodes. The performance of Kocite(R) materials as electrocatalysts has been studied. The second part of the program is directed toward evaluating the performance of Kocite(R) materials as platinum catalyst supports. Results to date indicate promising fuel cell performance at unusually low platinum loadings. GRA

N76-11576# Energy Research Corp., Danbury, Conn.
NEW MATERIALS FOR FLUORO SULFONIC ACID ELECTROLYTE FUEL CELLS Semiannual Report, 7 Oct. 1974 - 7 Mar. 1975
Michael George and Bernard S. Baker Jun. 1975 19 p refs
(Contract DAAK02-75-C-0045; DA Proj. 1G7-627087-AH-267)
(AD-A012284; ERC-0123-S) Avail: NTIS CSCL 10/2

Trifluoromethane sulfonic acid monohydrate (TFMSA-H2O), was evaluated as an electrolyte for matrix type fuel cells using conventional Teflon bonded platinum black electrodes. Pressure compensation was used to overcome the unique wetting characteristics of the acid. Limited test data was obtained at 200F that showed the TFMSA-H2O was superior to phosphoric acid at low current densities. Difficulties were encountered in preventing cross gas leakage during cell test caused both by matrix degradation and vaporization of free acid. GRA

N76-11577# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
AIRBORNE POWER SYSTEMS ANALYSIS Final Report, 15 Feb. - 15 Aug. 1974
Tommy R. Burkes Jun. 1975 46 p
(Contract F29601-74-C-0045)
(AD-A012011; AFWL-TR-74-251) Avail: NTIS CSCL 10/2

The generation of high power, high voltage pulses in an airplane present several problems which must be simultaneously resolved. For example, electrical source voltage must be evaluated and selected in light of the pulsing scheme, source characteristics and the flight environment (high altitudes). Weight and volume of a pulser system are the major considerations but complexity, reliability, EMI and safety are also very important factors that must be considered. This report evaluates the near term applicability of several candidate power sources and pulse generation schemes for use in an aircraft. The analysis is made from system considerations and interfaces are defined. It is concluded that a turbo-alternator operating in resonance with the energy storage capacitors of several pulse forming networks will best meet present Air Force requirements. GRA

N76-11578# Federal Energy Administration, Washington, D.C.
FEDERAL ENERGY ADMINISTRATION ELECTRICITY CONFERENCE
Feb. 1975 206 p refs Conf. held at Washington, D. C., 19-20 Sep. 1974
(PB-242472/9; FEA/G-75/179) Avail: NTIS HC $7.75 CSCL 10B

The conference was devoted to a discussion of the serious financial problems which the electric utility industry is experiencing and electricity conservation. The present electric utility situation presents a serious threat to our nation's ability to achieve energy self-sufficiency over the next decade. Two of the more critical aspects of the current situation involve the ability of the utilities to obtain adequate financing for the shift to coal and nuclear generating plants and the implementation of more effective electrical energy conservation programs at every level. GRA

N76-11579# Carnegie-Mellon Univ., Pittsburgh, Pa.
SOLAR SEA POWER Quarterly Report, 1 Jul. - 30 Sep. 1974
Clarence Zener, Abraham Lavi, Robert R. Rothfus, Charles Kriebel, and Francis McMichael 31 Oct. 1974 17 p
(Grant NSF GI-39114)
(PB-242263/2; NSF/RA/N-74-200;
NSF/RANN/SE/GI-39114/PR-74-5; QR-5) Avail: NTIS HC $3.50 CSCL 10B

Layouts for the solar sea power plant (SSPP) system component are worked out taking into account components cost and availability, plant maintenance, and ocean mooring. A 100 MWe net SSPP has been costed for a stationary plant located off a Caribbean island where a delta T = 40 degree F can be realized. The cost ranges from a low of $290 to a high of $530 per kW at the bus bar. Transmission or additional energy conversion costs have not been included. Material requirements on a per kW basis for 100 MWe plant have also been established. GRA

N76-11580# Argonne National Lab., Ill.
SOLAR ENERGY CONCENTRATION Annual Progress Report, 1 Jul. - 31 Dec. 1974
R. Winston 31 Jan. 1975 128 p refs Prepared in cooperation with Chicago Univ., Ill.
(Grant NSF AER-75-01065)
(PB-242258/2; NSF/RA/N-75-024;
NSF/RANN/SE-AER-75-01065/PR-75) Avail: NTIS HC $6.00 CSCL 10B

A concentrating solar heater based on the compound parabolic design was constructed and tested. The principle characteristics of the collector are that it has a concentration factor = 3, and an angular acceptance (full angle) = 38 degrees. The large angular acceptance implies that bi-annual adjustment of the collector orientation is sufficient to accept direct solar radiation. Experimental results from outdoor tests show good agreement with theory and confirm the expected improvement in performance resulting from concentration. Such performance would be useful for space conditioning applications in a temperature range where flat plate collectors are marginal (130F above ambient). GRA

N76-11581# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
EVALUATION OF THE TWO-FIELD SYNCHRONOUS MACHINE TO IMPROVE POWER SYSTEM SECURITY Final Report, 15 Aug. 1972 - 31 Dec. 1974
P. C. Krause 31 Dec. 1974 60 p refs
(Grant NSF GI-35140)
(PB-242165/9; NSF/RA/N-75-022) Avail: NTIS HC $4.50 CSCL 10B

In addition to the analysis and evaluation of the two-field synchronous machine, dynamic stability investigations and a new method of developing dynamic equivalents are given. A pump-storage system instability which was analyzed and corrected using results of this research is described. GRA

N76-11582# Massachusetts Univ., Amherst.
A PROPOSED OCEAN THERMAL ENERGY CONVERSION SYSTEMS PROGRAM PLAN (THE OTECS PLAN)
William E. Hernoemus Mar. 1975 72 p
(Grant NSF GI-34979)
(PB-242248/3; NSF/RA/N-75-030) Avail: NTIS HC $4.50 CSCL 10B

A program plan for development and acquisition of significant Ocean Thermal Energy Conversion Systems (OTECS) is presented. Existing research results are to be reduced to one or more bidder's packages via a contract definition phase evolution of one year conducted from a new and appropriately staffed program management headquarters. A standardized nomenclature system for description of any OTECS is presented. A technical development plan derived from existing research results is presented in considerable detail. Finally, a program summary is presented. GRA

N76-11583# Carnegie-Mellon Univ., Pittsburgh, Pa.
MAJOR ELECTRIC EQUIPMENT COST FIGURES FOR SOLAR SEA POWER PLANTS
Leo A. Finzi 31 Oct. 1974 49 p
(Grant NSF GI-39114)
(PB-242156/8; NSF/RA/N-74-201;
NSF/RANN/SE/GI-39114/TR-74-5) Avail: NTIS HC $4.00 CSCL 10B

These figures are based on actual manufacturers' data. In addition, the dependence of cost on speed, frequency and shaft orientation for rotating machines is derived. The appendix includes the rules of similitudes of transformers and electric machines so that performance and materials requirements for different ratings can be derived from a given design and rating. GRA

N76-11584# Massachusetts Univ., Amherst. Energy Alternatives Program.
DESIGN AND OFF-DESIGN PERFORMANCE ANALYSIS OF OCEAN THERMAL DIFFERENCE POWER PLANT TURBINES
R. J. Veenema, Jr. and L. L. Ambs May 1975 120 p refs
(Grant NSF GI-34979)
(PB-242152/7; NSF/RA/N-75-031;
NSF/RANN/SE/GI-34979/TR-75-5) Avail: NTIS HC $5.50 CSCL 10B

A procedure was developed to determine the axial-flow turbine design that operates at the maximum attainable efficiency for the design specific speed. The procedure uses the results of Balje's optimization study and accounts for the Reynolds number variation of Balje's optimized parameters. The procedure has been used to study the variation of the design parameters of ammonia and propane OTDM turbines. A procedure has been developed to predict the off-design performance of turbines designed by the previously mentioned design procedure. The inlet state, mass flow and rotational speed have been varied to produce performance maps for a series of ammonia and propane OTDM turbines. GRA

N76-11585# Electric Power Research Inst., Palo Alto, Calif.
AN OVERALL PROGRAM FOR THE DEVELOPMENT OF OPEN CYCLE MHD POWER GENERATION
1 May 1975 107 p
(PB-242585/8; EPRI-SR-12) Avail: NTIS HC $5.50 CSCL 10B

Open cycle MHD electrical power generation offers the potential of greatly improved efficiency in the use of coal and other fossil fuels. The program described in this document has been formulated to illustrate the type of overall planning required for the development of open cycle MHD power generation, and to provide an initial framework for the coordination of research

efforts. The main emphasis of the program is on direct coal firing of open cycle MHD systems, although significant attention is directed toward the use of clean fuels. GRA

N76-11586# Allied Chemical Corp., Buffalo, N.Y. Specialty Chemicals Div.
DEVELOPMENT OF NEW WORKING FLUIDS FOR SOLAR RANKINE HEAT PUMPS Annual Progress Report, 1 May - 31 Dec. 1974
R. A. Allen 31 Jan. 1975 29 p refs
(Grant NSF GI-42506)
(PB-242196/4; NSF/RA/N-75-023; NSF/RANN/SE/GI-42506/PR/74-4) Avail: NTIS HC $4.00 CSCL 13A

The effect of the thermodynamic properties of working fluids on the performance of a solar powered heat pump has been analyzed. Cycle and overall efficiencies have been calculated for approximately 35 halocarbons and other substances. The fluids are classified by boiling points and results are tabulated for operation both in cooling and heating modes. Plots are also presented indicating the variation of efficiencies with the maximum temperature, degree of regeneration, and condenser and evaporator temperatures. Of the fluids considered, R-11, R-113, R-132b, R-142, R113/152 and toluene have the highest overall efficiencies for a single fluid system operating at an upper temperature of 180F. GRA

N76-11587# Arizona Univ., Tucson. Optical Sciences Center.
RESEARCH APPLIED TO SOLAR-THERMAL POWER CONVERSION. VOLUME 1: EXECUTIVE SUMMARY Final Report, 1 Jun. 1971 - 31 Jan. 1973
Aden Meinal 1973 21 p
(Contract F33615-68-C-7111; Grant NSF GI-30022)
(PB-242086/7; NSF/RANN/SE/GI-30022/FR-73-1; NSF/RA/N-73-010-Vol-1) Avail: NTIS HC $3.50 CSCL 20F

Solar absorbing coatings of high selectivity, (a/e), and their influence on system design, operation, and economics are studied. Two basically different approaches to high (a/e) coatings were followed: (1) interference thin film coatings and (2) intrinsic absorber coatings using chemically vapor-deposited (CVD) silicon as the absorbing component. GRA

N76-11588# Arizona Univ., Tucson. Optical Sciences Center.
RESEARCH APPLIED TO SOLAR-THERMAL POWER CONVERSION. VOLUME 2: FINAL REPORT Final Report, 1 Jun. 1971 - 31 Jan. 1973
Aden Meinal 31 Jan. 1973 215 p refs
(Contract F33615-68-C-7111; Grant NSF GI-30022)
(PB-242087/5; NSF/RANN/SE/GI-30022/FR-73-2; NSF/RA/N-73-011) Avail: NTIS HC $7.75 CSCL 20F

Laboratory fabrication and measurement of solar absorbing coatings of high selectivity, (a/e), and their evaluation for use in electrical power production by means of thermodynamic cycles are discussed. Two types of selective coatings were evaluated: one using interference thin film stacks, and the second using intrinsic optical absorption of CVD silicon. GRA

N76-11651 Strathclyde Univ., Glasgow (Scotland). Dept. of Applied Physics.
ENERGY BALANCE OF CROPS
T. Woodhead *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 86-92 refs (For availability see N76-11640 02-47)
Copyright.

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-11589*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE NOISINESS OF LOW-FREQUENCY ONE-THIRD OCTAVE BANDS OF NOISE M.S. Thesis - Southampton Univ.
Ben William Lawton Washington Nov. 1975 30 p refs Prepared in cooperation with Southampton Univ. (England)
(NASA-TN-D-8037; L-10082) Avail: NTIS HC $4.00 CSCL 13B

This study examined the relative noisiness of low frequency one-third octave bands of noise bounded by the bands centered at 25 Hz and 200 Hz, with intensities ranging from 50 db sound pressure level (SPL) to 95 db SPL. The thirty-two subjects used a method-of-adjustment technique, producing comparison-band intensities as noisy as standard bands centered at 100 Hz and 200 Hz with intensities of 60 db SPL and 72 db SPL. Four contours of equal noisiness were developed for one-third octave bands, extending down to 25 Hz and ranging in intensity from approximately 58 db SPL to 86 db SPL. These curves were compared with the contours of equal noisiness of Kryter and Pearsons. In the region of overlap (between 50 Hz and 200 Hz) the agreement was good. Author

N76-11590# Puerto Rico Nuclear Center, Mayaguez.
RADIOACTIVE WASTE IN THE MARINE ENVIRONMENT
F. G. Lowmann 1975 17 p refs Sponsored by ERDA
(TID-26833) Avail: NTIS HC $4.00

The introduction of radionuclides into near-shore marine areas is considered in relation to Federal Regulations and to the hazards posed to man and to marine organisms living near the site of introduction of the contaminants. The use of the critical pathway concept, for evaluating hazards to man from radionuclides in his food, is discussed and the specific activity concept is applied to demonstrate the degree of hazard to man which could result from normal reactor operation using sea water for the coolant. The relative hazards to marine organisms from naturally occurring and reactor-produced radionuclides are also evaluated. Author (NSA)

N76-11591# Battelle Pacific Northwest Labs., Richland, Wash.
METEOROLOGICAL CONSIDERATIONS IN THE INTERPRETATION OF THE TIME VARIATION OF RADIOACTIVITY AND CONCENTRATION OF OTHER POLLUTANTS
T. D. Fox, L. L. Wendell, and J. D. Ludwick 17 Nov. 1975 287 p refs Sponsored by ERDA
(BNWL-1950-Pt-3) Avail: NTIS HC $7.60

If there is no significant low level source, such as a nuclear device detonation, high concentrations at the ground can occur only if there is a vertical atmospheric transport mechanism which moves these materials from high levels through the depth of the troposphere. Mechanisms of downward transport suggested by the preliminary data are summarized. A second group of atmospheric trace materials to be considered includes those whose source region is the earth. In studying the variations in concentrations of these materials, horizontal transport is the prime mechanism under consideration, although vertical movement may play a role. The variations in hourly condensation nuclei concentrations, and in daily lead (Pb) concentrations, were examined. A coarse examination of the data suggests that the lowest Pb and condensation nuclei concentrations are usually observed in an air mass within two days of a frontal passage and that significant reductions in condensation nuclei concentrations corresponding to precipitation episodes indicate removal by scavenging. NSA

N76-11592# Electric Power Research Inst., Palo Alto, Calif.
HEALTH EFFECTS OF FOSSIL FUEL COMBUSTION PRODUCTS
Cyril L. Comar May 1975 75 p refs Workshop held at Indian Wells, Calif., 11-13 Nov. 1974; sponsored by Cornell Energy Proj. and Electric Power Res. Inst.
(PB-242418/2; EPRI-SR-11) Avail: NTIS HC $4.50 CSCL 13B

The workshop is the first of a series of specialized meetings to provide considered and authoritative guidance for the research needed on a national basis and by the utility industry to assure that energy needs are met with a minimum environmental cost. The emphasis of this workshop was entirely on the scientific basis for decision making related to the health effects of the fossil fuel combustion products on human health and well-being. The report restricts itself primarily to brief judgmental positions on the state of knowledge relating air pollution to health. The report represents an attempt to define research directions aimed at filling these energy needs safely. GRA

N76-11593# Aerospace Corp., El Segundo, Calif. Urban Programs Div.
MEDIUM DUTY VEHICLE EMISSION CONTROL COST EFFECTIVENESS COMPARISONS. VOLUME 1: EXECUTIVE SUMMARY
M. G. Hinton, J. Meltzer, T. Iura, J. A. Drake, and L. Forrest Jan. 1974 57 p
(Contract EPA-68-01-0417)
(PB-242246/7; ATR-74(7327)-1-Vol-1; EPA-460/3-74-004-a) Avail: NTIS HC $4.50; HC also available from NTIS $11.00/set of 2 reports as PB-242245-SET CSCL 13B

The results of a comparative analysis of the cost effectiveness of medium-duty vehicle are presented. It compares emission control cost factors (expressed as dollars expended per ton of pollutant removed) of medium duty vehicles, light duty vehicles, heavy duty vehicles, utility power plants, and a number of other stationary sources. Mobile source emission inventories were calculated for the New York City, Los Angeles, and Phoenix-Tucson Air Quality Control Regions. The results indicate that, in the mobile source area, emission control cost factors ($/ton) in general decrease in numerical value as the vehicle weight increases. GRA

N76-11594# Science Applications, Inc., McLean, Va.
SURFACE EFFECTS SKIMMER DEVELOPMENTS Final Report
Nicholas P. Trentacoste Jun. 1975 79 p refs
(Contract EPA-68-03-0327)
(PB-242391/1; EPA-670/2-75-066) Avail: NTIS HC $5.00 CSCL 13B

This experimental program investigated the use of a surface effects skimmer in removing thin film oil slicks spread over large water areas by fast currents. This new skimmer uses a directed air jet to separate and lift spilled oil from the surface of the water in the form of a spray consisting of oil and water droplets. The oil/water spray is directed toward a rotating belt of polyurethane foam from which it is squeezed and pumped to a nearby storage tank. Tow tank tests were conducted at speeds up to 3.25 knots in calm, choppy and smooth wave conditions with oils ranging from a very viscous Venezuelan crude to a very light No. 4 distillate fuel oil. In a related series of experiments, it was found that presoaking the polyurethane foam belt in either water or oil had no effect on its ability to retain oil. GRA

N76-11595# Naval Civil Engineering Lab., Port Hueneme, Calif. Naval Construction Battalion Center.
THE COANDA EFFECT OIL/WATER SEPARATOR: A DEVELOPMENT STUDY Final Technical Note, Nov. 1972 - Sep. 1974
D. Pal May 1975 45 p refs
(AD-A011806; CEL-TN-1389) Avail: NTIS CSCL 07/1

A new method of separating free oil from oil/water mixtures is under development at the Civil Engineering Laboratory. This technique uses the fluid-dynamic phenomenon, called the wall attachment, or Coanda effect; such a separator would be considerably smaller than the conventional gross separators of the laminar flow types. This report describes in detail the development program of the separator from the original single-stage separator through the 20-gpm multi-stage separator. GRA

N76-11596# Olson Labs., Inc., Anaheim, Calif.
FTP/SHORT CYCLE CORRELATION TESTING FOR 207(B) IMPLEMENTATION - CATALYST EQUIPPED VEHICLES, VOLUME 2 Final Report
J. A. Gunderson Apr. 1975 396 p
(Contract EPA-68-03-0452)
(PB-242589/0; EPA-460/3-75-003-b-Vol-2) Avail: NTIS HC $10.75 CSCL 14B

This volume contains appendices to a report comparing five existing short-cycle emissions tests to the Federal test procedure. Included are emission test results, test fuel analysis, analyzer calibration curves, the CUS calibration curve, dynamometer calibration curves, and the Ford catalyst test vehicle maintenance history. GRA

N76-11597# Olson Labs., Inc., Anaheim, Calif.
FTP/SHORT CYCLE CORRELATION TESTING FOR 207(B) IMPLEMENTATION - CATALYST EQUIPPED VEHICLES, VOLUME 1 Final Report
J. A. Gunderson Apr. 1975 50 p
(Contract EPA-68-03-0452)
(PB-242588/2; EPA-460/3-75-003-a-Vol-1) Avail: NTIS HC $4.00 CSCL 14B

The objective of the work performed was to provide test data leading to the identification of which of five existing short-cycle emissions tests is most capable of being correlated with the Federal test procedure as used for the certification of 1975 model year and later light-duty vehicles. The five short-cycle emission tests are: Clayton key mode - volumetric procedure; Federal three-mode - volumetric procedure; unloaded test, high speed (2,500 rpm) and idle (derived from 1 and 2) - volumetric procedure; Federal short cycle (9-mode) - CVS procedure; and composite N.J. ACID/N.Y. short test - CVS procedure. Fifty-eight catalyst equipped experimental vehicles were tested. Design, equipment, and data handling are described. GRA

N76-11598# Maryland Univ., College Park.
STUDY OF THE EMISSIONS FROM MAJOR AIR POLLUTION SOURCES AND THEIR ATMOSPHERIC INTERACTIONS Progress Report, 1 Nov. 1972 - 31 Oct. 1974
Glen E. Gordon Oct. 1974 351 p refs
(Grant NSF GI-36338)
(PB-242581/7; NSF/RA/E-74-059) Avail: NTIS HC $10.50 CSCL 13B

Trace element analyses of size graded particulates are presented for coal- and oil-fired power plants, municipal incinerators, airports, highways, and continental background. Ground level and airborne surveys of power plant plumes include measurements of condensation nuclei and sulfur dioxide along with observations by integrating nephelometer and mass monitor. Other airborne plume surveys investigate interactions between ozone and nitrogen oxides in power plant plumes. Laboratory determinations are provided for kinetic constants of 30 chemical reactions of possible importance in atmospheric chemistry. GRA

N76-11599# Geraghty and Miller, Inc., Port Washington, N.Y.
GROUND WATER POLLUTION PROBLEMS IN THE NORTHWESTERN UNITED STATES
Frits VanDerLeeden, Lawrence A. Cerrillo, and David W. Miller May 1975 378 p refs
(Contract EPA-68-03-0298)
(PB-242860/5; EPA-660/3-75-018) Avail: NTIS HC $10.75 CSCL 13B

An evaluation of ground-water problems was carried out in six states in the northwest: Colorado, Idaho, Montana, Oregon, Washington and Wyoming. The most common natural ground-water quality problems, other than high salinity, are excessive hardness, iron, maganese, and fluoride. Principal sources of man-caused ground-water quality problems in the approximate order of severity are: discharge of effluent from septic tanks and sewage treatment plants, irrigation return flow, dryland farming, abandoned oil wells, shallow disposal wells, unlined surface impoundments, mine tailings and mine drainage, municipal and industrial landfills, and radioactive waste disposal. Other sources considered include: spills and leaks, application of fertilizers and pesticides, feedlots, and salt-water intrusion. GRA

N76-11600# Engineering-Science, Inc., McLean, Va.
TESTING OF A MOLECULAR SIEVE USED TO CONTROL MERCURY EMISSION FROM A CHLOR-ALKALI PLANT, VOLUME 1 Final Environmental Protection Technology Series, Sep. 1974 - Jan. 1975
John T. Chehaske and John R. Cline Mar. 1975 62 p refs
(Contract EPA-68-02-1406)
(PB-242005/7; EPa-650/2-75-026-A-Vol-1) Avail: NTIS HC $4.25; HC also available $11.00/set of 2 reports as PB-242004-SET CSCL 13B

Performance testing for mercury emission control was conducted on the Union Carbide PuraSiv Hg unit currently controlling mercury emissions from the by-product hydrogen stream of the mercury-cell chlor-alkali production facility of Sobin Chlor-Alkali in Orrington, Maine. Simultaneous samplings of adsorber inlet and outlet steams were performed during five consecutive 24-hour adsorption cycles, eight sampling runs per

cycle, in accordance with a modified version of EPA Reference Method 102. If operated at design capacity, the estimate outlet mercury concentrations from the PuraSiv Hg unit would average 2.0 micrograms/cu Nm throughout each adsorption cycle, representing a 99.9% collection efficiency. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N76-11601* National Aeronautics and Space Administration, Washington, D.C.
SATELLITE TO MEASURE EQUATORIAL OZONE LAYER
[1975] 15 p
(NASA-News-Release-75-290) Avail: NASA Scientific and Technical Information Facility P. O. Box 8756, Baltimore/Washington International Airport, Md. 21240 CSCL 04A

The Atmosphere Explorer E (Explorer 55) Satellite is described. The satellite will gather information on the earth's upper atmosphere, particularly regarding the condition of the protective ozone layer. The satellite will also provide information concerning the earth's heat balance, and heat flow characteristics, and energy conversion mechanisms. D.M.L.

N76-11602*# Transemantics, Inc., Washington, D.C.
THE EARTH: GRAVITATIONAL FIELD
A. Bachmanov Washington NASA Oct. 1975 10 p Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 7, Jul. 1975 p 38-39
(NASw-2792)
(NASA-TT-F-16591) Avail: NTIS HC $3.50 CSCL 03C

Data relating how control is exercised over the flight of a spacecraft are given along with an impression of the complex and responsible work of the specialists who support the flight. Author

N76-11603*# Transemantics, Inc., Washington, D.C.
ESTIMATE OF THE ACCURACY OF CONSTRUCTING AN UPPER-ATMOSPHERE DENSITY MODEL FROM THE DECELERATION OF AN ARTIFICIAL EARTH SATELLITE
P. M. Vingardt Washington NASA Oct. 1975 18 p refs Transl. into ENGLISH of "Otsenka tochnostipostroyeniya modeli plotnosti verkhney atmosfery po tormozheniyu ISZ", Rept. PR-218 Acad. of Sci. of the USSR Inst. of Space Res., Moscow p 1-20
(Contract NASw-2792)
(NASA-TT-F-16603; PR-218) Avail: NTIS HC $3.50 CSCL 04A

The accuracy of constructing an analytical model of upper-atmosphere density with a consideration of the influence of the daily effect is estimated. The method presented for obtaining minimum and maximum estimates allows the determination of the set of orbits of artificial earth satellites, whose analysis yields optimum guaranteed accuracies of determining the density model parameters and the density values themselves. The magnitude of the average number of satellite revolutions that is sufficient to ensure the indicated accuracies is given. Author

N76-11604*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
F-REGION DRIFT VELOCITIES FROM INCOHERENT-SCATTER MEASUREMENTS AT MILLSTONE HILL
Lynn A. Carpenter and Volker W. J. H. Kirchhoff 17 Oct. 1975 39 p refs
(Contract NGL-39-009-003)
(NASA-CR-145743; PSU-IRL-SCI-D-437) Avail: NTIS HC $4.00 CSCL 04A

F-region drift velocities measured at Millstone Hill from 1968 to 1974 are presented in tabular form. A brief description of the measurement procedures is also given. Author

N76-11605*# Techtran Corp., Glen Burnie, Md.
STOCHASTIC STRUCTURE OF CLOUD AND RADIATION FIELDS
Yu. R. Mullamaa, M. A. Sulev, V. K. Poldmaa, H. A. Ohvril, H. J. Niylisk, M. I. Allenov, L. G. Tchubakov, and A. F. Kuusk Washington NASA Oct. 1975 193 p refs Transl. into ENGLISH of the book "Stokhasticheskaya Struktura Poley Oblachnosti i Radiatsii" Acad. of Sci. of the Estonian SSR (Tartu), 1972 p 1-283
(Contract NASw-2485)
(NASA-TT-F-822) Avail: NTIS HC $7.50 CSCL 04A

Theoretical and experimental studies on the stochastic structure of cloud fields and radiation of the earth's atmosphere are reported. A description is given of the array of equipment developed and used to conduct ground and aircraft experimental studies. A survey is made of the measurement methods and the theory of random processes employed in theoretical analysis. A detailed description is given of the results of the experimental studies and a comparison is made with the theoretical model established. Author

N76-11606*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BIDIRECTIONAL PLANT CANOPY REFLECTION MODELS DERIVED FROM THE RADIATION TRANSFER EQUATION
Donald R. Beeth Washington Nov. 1975 110 p refs
(NASA-TN-D-8106; JSC-S-430) Avail: NTIS HC $5.50 CSCL 20F

A collection of bidirectional canopy reflection models was obtained from the solution of the radiation transfer equation for a horizontally homogeneous canopy. A phase function is derived for a collection of bidirectionally reflecting and transmitting planar elements characterized geometrically by slope and azimuth density functions. Two approaches to solving the radiation transfer equation for the canopy are presented. One approach factors the radiation transfer equation into a solvable set of three first-order linear differential equations by assuming that the radiation field within the canopy can be initially approximated by three components: uniformly diffuse downwelling, uniformly diffuse upwelling, and attenuated specular. The solution to these equations, which can be iterated to any degree of accuracy, was used to obtain overall canopy reflection from the formal solution to the radiation transfer equation. A programable solution to canopy overall bidirectional reflection is given for this approach. The special example of Lambertian leaves with constant leaf bidirectional reflection and scattering functions is considered, and a programmable solution for this example is given. The other approach to solving the radiation transfer equation, a generalized Chandrasekhar technique, is presented in the appendix. Author

N76-11607*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRESSURE CONTACT SOUNDING DATA FOR NASA'S ATMOSPHERIC VARIABILITY EXPERIMENT (AVE 3)
Henry E. Fuelberg, C. Kelly Hill, Robert E. Turner, and Kay E. Long Washington Nov. 1975 25 p refs
(NASA-TN-D-8097) Avail: NTIS HC $3.50 CSCL 04A

The basic rawinsonde data are described at each pressure contact from the surface to sounding termination for the 41 stations participating in the AVE III measurement program that began at 0000 GMT on February 6 and ended at 1200 GMT on February 7, 1975. Soundings were taken at 3-hour intervals during a large period of the experiment from most stations within the United States east of about 105 degrees west longitude. Methods of data processing, change in reduction scheme since the AVE II pilot experiment, and data accuracy are briefly discussed. An example of contact data is presented, and microfiche cards of all the contact data are included in the appendix. The AVE III project was conducted to better understand and establish the extent of applications for meteorological satellite sensor data through correlative ground truth experiments and to provide basic experimental data for use in studies of atmospheric scales of-motion interrelationships. Author

N76-11608*# Maryland Univ., College Park.
RELATIVISTIC ELECTRON PRECIPITATION IN THE AURORAL ZONE Ph.D. Thesis
David J. Simons 1975 200 p refs

(Grant NGR-21-002-308)
(NASA-CR-145609) Avail: NTIS HC $7.50 CSCL 04A

The energy spectra and pitch angle distributions of electrons in the energy range from 50 keV to 2 MeV were determined by a solid state electron energy spectrometer during the Relativistic Electron Precipitation (REP) event of 31 May 1972. The pitch angle distributions were determined from a knowledge of the rocket aspect and the direction in space of the earth's magnetic field. The rocket aspect determination was therefore treated in depth and a method was developed to compensate for the malfunctioning of the aspect magnetometer. The electron fluxes during the REP event were highly variable demonstrating correlated energy, flux, and pitch angle pulsations with time periods of less than one second. A theoretical model for the production of relativistic electrons was proposed. It follows from this model that, at comparatively low background electron densities, the anomalous Doppler resonance leads to the acceleration of near relativistic particles. Author

N76-11609# Joint Inst. for Nuclear Research, Dubna (USSR).
CONONICAL FIELD QUANTIZATION IN AN EXTERNAL TIME-DEPENDENT GRAVITATIONAL FIELD: RESTRICTIONS FROM THE GENERAL PROPERTIES OF FEYNMAN PROPAGATOR
S. B. Ilin (Saratov State Univ.) 1975 27 p refs
(JINR-E2-8636) Avail: ERDA Depository Libraries

The Green functions of the quantum scalar field interacting with gravitation of the homogeneous isotropic closed universe are studied. They were determined as an expectation value of the time-ordered product of two field operators in the cyclic states of various, in general, unitary-nonequivalent representations of canonical commutation relations. The regularity properties of these functions are shown to be the same as of the Feynman propagator obtained previously for arbitrary Riemannian space-time only in the representations that form a class of unitary equivalence. Author (NSA)

N76-11610# Weapons Research Establishment, Salisbury (Australia).
EMPIRICAL MODEL OF GLOBAL SPREAD-F OCCURRENCE
D. G. Singleton Sep. 1974 17 p refs
(WRE-TN-1241(WR/d)) Avail: ERDA Depository Libraries HC $4.00

A method of combining models of ionospheric F layer peak electron density and irregularity incremental electron density into a model of the occurrence probability of the frequency spreading component of spread F is presented. The predictions of the model are compared with spread F occurrence data obtained under sunspot maximum conditions. Good agreement is obtained for geomagnetic latitudes below 70 deg. At higher latitudes, a blackout factor allows the model to accurately represent the data. The blackout factor is ascribed to the effect of polar blackout on the spread F statistics and/or the lack of a definitive incremental electron density model for irregularities at polar latitudes. Ways of isolating these effects and assessing their relative importance in the blackout factor are discussed. The model, besides providing estimates of spread F occurrence on a worldwide basis, also furnishes a means of further checking the irregularity incremental electron density model on which it is based. Author (NSA)

N76-11611# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
ELECTRIC FIELD AND PLASMA MEASUREMENTS IN THE AURORAL IONOSPHERE PRIOR TO A MAGNETIC SUBSTORM
U. Fahleson, C. G. Faelthamar, and A. Pedersen (ESTRC) Jun. 1974 11 p refs
(TRITA-EPP-74-14) Avail: NTIS HC $3.50

Electric field and Langmuir probe experiments flown on the ESRO S 87/2 rocket from Esrange, Sweden, prior to a substorm are detailed. Characteristic changes of the electric field and ionospheric plasma in connection with the appearance of weak auroral activity overhead were found. The electric field, which is initially about 40mV/m northward, decreases to 20mV/m and turns temporarily eastward by 15 deg. Simultaneously plasma density and temperature increases were observed. ESA

N76-11612# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
ELECTRIC CURRENT STRUCTURE OF THE MAGNETOSPHERE
Hannes Alfven Apr. 1975 25 p refs Presented at the Nobel Symp. on Phys. of the Hot Plasma in the Magnetosphere, Kiruna, Sweden, 2-4 Apr. 1975
(TRITA-EPP-75-03) Avail: NTIS HC $3.50

Various theories on the magnetospheric current system are reviewed. The pseudo plasma, which is basically different from the real plasma, is discussed. Because in the pseudo plasma theory the electric current is eliminated, phenomena such as anomalous resistivity, formation of electrostatic double layers, current disruption, and energy transfer cannot be described adequately. Therefore a simple model of the magnetospheric current (caused by the immersion of the magnetosphere in the solar wind electric field) system was constructed. A similar approach was used to analyze the cosmosonic problem of angular momentum transfer, the current system in interplanetary space and in the Jovian magnetosphere, and finally a model of double radio sources. ESA

N76-11613# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
MECHANISMS FOR DRIVING BIRKELAND CURRENTS
Rolf Bostroem Apr. 1975 24 p refs Presented at the Nobel Symp. on Phys. of the Hot Plasma in the Magnetosphere, Kiruna, Sweden, 2-4 Apr. 1975
(TRITA-EPP-75-07) Avail: NTIS HC $3.50

Basic mechanisms for the generation of Birkeland currents in the magnetosphere are discussed. Using magnetohydrodynamic equations it was found that both plasma convection and pressure can account for currents of the observed magnitude. For pressure driven currents the current distribution implies that the morning and evening flows must balance so that there is no net current flow in the ionosphere across certain specified contours. For plasma convection currents the morning and evening current systems may be independent. Finally, secondary Birkeland currents of ionospheric origin, tending to discharge ionospheric polarization electric fields, were investigated. ESA

N76-11614# Royal Aircraft Establishment, Farnborough (England).
UPPER-ATMOSPHERE ROTATION RATE FROM ANALYSIS OF THE ORBITAL INCLINATION OF EXPLORER
Doreen M. C. Walker Jun. 1975 19 p refs
(RAE-TR-75066; BR47899) Avail: NTIS HC $3.50

Theoretical curves were fitted to the values of inclination of the explorer 1 sufelle k, giving three values of the average atmospheric rotation rate at heights of 350 to 400 km, and latitudes 0 to 20 deg. Feb. 1958 to mid 1960, 1.5 rev/day; Mid 1960 to Dec. 1967, 1.2 rev/day; and Jan. 1968 to Mar. 1970, 1.3 rev/day. Solar activity was very high in 1958 to 1960, low from 1961 to 1967, and high in 1968 to 1970; so the results strongly suggest that the rotation rate depends on solar activity, being greatest when the sun is most active. Analysis of the inclination at 14th-order resonance gave values of the lumped 14th-order harmonics in the geopotential. Author (ESA)

N76-11615# Kiruna Geophysical Observatory (Sweden).
AN EXPERIMENTAL STUDY OF LOW ENERGY ELECTRON BACKSCATTERING IN THE ATMOSPHERE
B. N. Maehlum (Norweg. Defence Res. Estab., Kjeller), P. Christophersen, and L. A. Holmgren Apr. 1975 29 p refs
(KGI-Preprint-75-302) Avail: NTIS HC $4.00

How variations in the pitch angle and energy distributions of low energy electrons may affect the backscatter ratio and, also the electron component of the upward Birkeland current is shown. Sofening of the electron energy spectrum combined with a field-alignment of the electron fluxes may enhance the current carried by the greater than 200 eV energy electrons significantly. Author (ESA)

N76-11616# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
FIELD TEST OF A THREE-CHANNEL SEISMIC EVENT DISCRIMINATOR Final Technical Report
Sheldon W. Buck, David S. Burns, and Lawrence J. Freier Mar. 1975 33 p

(Contract F44620-74-C-0053)
(AD-A011655; R-864) Avail: NTIS CSCL 08/11

A practical three-channel seismic event discriminator breadboard was employed at the Harvard College Observatory to monitor, in real time, three short-period seismometers. The major objective for placing this breadboard system in the field was to demonstrate that preprocessing of seismic data on-site (thereby reducing recording and transmitting requirements) is a viable and workable concept. Background information pertaining to the event discriminator test plan experimental test installation, inluding the seismo meter set up, interfaces and recording equipment interface circuits, calibration procedures, and test results of the seismometers is provided. A summary and interpretation of in-field testing data is presented. Author

N76-11617# Texas Instruments, Inc., Dallas. Equipment Group.

COMPARISON OF COHERENT AND INCOHERENT BEAMFORMING ENVELOPE DETECTORS FOR NORSAR REGIONAL SEISMIC EVENTS

Wen-Wu Shen 31 Dec. 1974 80 p refs
(Contract F08606-74-C-0033; ARPA Order 2551)
(AD-A012297; TI-ALEX(01)-TR-74-06; TR-6) Avail: NTIS CSCL 17/10

The performance of the conventional coherent beam envelope detector and the incoherent beam envelope detector were studied and compared using short-period Norwegian Seismic Array (NORSAR) data from regional earthquakes and presumed explosions. The detectors were evaluated in two frequency bands in terms of detection performance, false alarm characteristic, and the resultant operating characteristic. A detector using the envelope of the array beam computed with the Hilbert transform was also examined. GRA

N76-11618# Texas Instruments, Inc., Dallas. Equipment Group.

MAXIMUM LIKELIHOOD ESTIMATION OF SEISMIC EVENT MAGNITUDE FROM NETWORK DATA

Frode Ringdal 27 Mar. 1975 70 p refs
(Contract F08606-75-C-0029)
(AD-A012296; WTI-ALEX(01)-TR-75-01; TR-1) Avail: NTIS CSCL 17/10

Seismic networks often tend to overestimate the magnitude of earthquakes, because those stations within the network that do not detect a particular event are ignored in the conventional magnitude averaging procedure. By assuming a normal distribution of world-wide magnitudes for any given event, it is possible to establish a simple statistical model that includes the additional information that the event magnitude at nondetecting stations must be below a certain threshold value. In this report, maximum likelihood estimation is applied to determine event magnitude based on this model. The advantages and limitations of the technique are discussed using both simulated and real data. GRA

N76-11619# Analysis and Computer Systems, Inc., Burlington, Mass.

AN INVESTIGATION OF THE DETERMINATION OF THERMOSPHERIC DENSITIES BY SOLAR EUV ABSORPTION Interim Report

Peter W. Lindstrom Apr. 1975 69 p refs
(Contract F19628-74-C-0169)
(AD-A012291; SR-1; AFCRL-TR-75-0235) Avail: NTIS CSCL 04/1

Analyzed are various techniques for determining the number densities of atmospheric constituents. The experimental data that these techniques employ are absorption profiles of EUV solar radiation. One method analyzed is that of computing the densities by solving the linear extinction coefficient equations. Methods that assume diffusive equilibrium and a knowledge of the temperature profile are also analyzed. A method of determining an optimal payload of wavelength detectors to be used for computing the densities in a manner which minimizes the effect of the statistical uncertainty in the absorption profiles is presented. GRA

N76-11620# Texas Instruments, Inc., Dallas. Equipment Group.

AN EVALUATION OF ADAPTIVE-BEAMFORMING TECHNIQUES APPLIED TO RECORDED SEISMIC DATA

Thomas E. Barnard and Leo J. OBrien 31 Dec. 1974 289 p refs
(Contract F08606-74-C-0033; ARPA Order 2551)
(AD-A011849; TI-ALEX(01)-TR-74-08) Avail: NTIS CSCL 17/10

This report presents time-domain maximum likelihood adaptive beamforming results for data from the Alaska Long-Period Array and the Korean Short-Period Array. Adaptive-beamforming detection gain relative to beamsteering is investigated for unmixed long-period seismic events in the presence of background noise and for simulated mixed events where two data samples, each containing a signal, are summed to create a composite sample containing an interfering event. In the adaptive beamforming studies for background noise, the performance of two different adaptive algorithms, the effect of using closely-spaced partial arrays instead of the full ALPA array, and the effect of different frequency filters applied to the input channels before array beamforming are examined. In the interfering-event analysis, the relative on-azimuth to off-azimuth event strength at which an on-azimuth event detection is possible determines the detection gain of adaptive multichannel filtering over time-shift-and-sum beamforming. GRA

N76-11621# Wayne State Univ., Detroit, Mich. Research Inst. for Engineering Sciences.

STUDIES OF ATMOSPHERIC PROCESSES Final Report, 12 Jul. 1971 - 30 Jun. 1974

Edward R. Fisher, Paul B. Foreman, Barbara B. Krieger, Ralph H. Kummler, and A. Bryan Lees Nov. 1974 146 p refs
(Contract F19628-72-C-0007; ARPA Order 1856; AF Proj. 1856)
(AD-A011773; AFCRL-TR-74-0584) Avail: NTIS CSCL 07/4

This report summarizes experimental and analytical studies on chemistry and energy transfer processes important to rocket exhaust components in the upper atmosphere. The first part covers the experimental studies on chemiluminescence observed in the infrared from reactions in the H-C-N system. The second part presents a compilation of artificial infrared spectra generated to aid in the experimental interpretation of Part I. Part III presents the results of detailed relaxation calculations in an expanding flow of combustion affluents. This calculation, simulating a core flow field, shows substantial vibrational freezing particularly in the diatomic species present. The last part presents detailed measurement of the scattering of O atoms from various plume related species. The intermolecular potential for these systems is also determined. GRA

N76-11622# Boston Coll., Chestnut Hill, Mass.

EVALUATION OF SEISMIC INSTRUMENTATION AND ANALYSIS OF SEISMIC DATA Final Report, 1 Nov. 1972 - 30 Jun. 1974

John G. Hogan, Car Syverson, Joseph I. Blaney, Jr., and Howard W. Kuenzler Jan. 1975 159 p
(Contract F19628-72-C-0013; AF Proj. 7628)
(AD-A011703; SR-1; AFCRL-TR-75-0081) Avail: NTIS CSCL 17/10

The Geokinetic Data Acquisition and Analysis System is described. Both the computer operating system and the general signal conditioning electronics are detailed. Special purpose programs required to support the collection and analysis of both geokinetic and inertial data generated in and around a Minuteman test silo area are presented. Special instrumentation and interfaces required to collect and analyze data from the Hill Air Force Base Experimental Test Facility are described. GRA

N76-11623# TRW Systems Group, Redondo Beach, Calif.

MONTE CARLO SIMULATION OF ION COLLECTION BY A ROCKET-BORNE MASS SPECTROMETER

Takashi Sugimura Feb. 1975 28 p refs
(Contract F19628-74-C-0128; AF Proj. 6687)
(AD-A011690; TRW-25717-6001-RU-00; AFCRL-TR-75-0240; SR-1) Avail: NTIS CSCL 07/4

The parametric study of the ion collection parameters for free molecule flow has been completed for the range of values of practical interest. It has been found that fairly simple relationships can be established for the variation of the ion flux

coefficient as a function of any one of the flow parameters; Debye number, speed ratio, and applied potential. Results for the transitional regime show trends similar to the collisionless case. Investigation of vehicle angle of attack and internal molecular degrees of freedom on the ion flux have been started, but preliminary results indicate the effects on the flux coefficient are small. GRA

N76-11624# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
SURFACE WAVES, SOURCE AND PATH PROPERTIES Scientific Interim Report
Donald J. Weidner 16 Apr. 1975 59 p refs
(Contract F19628-74-C-0092; ARPA Order 1795)
(AD-A011691; AFCRL-TR-75-0215; SR-1) Avail: NTIS CSCL 08/11

Several characteristics of oceanic surface waves can be altered by low rigidity sediments along the propagation path. Specifically spectral shape of both Love and Rayleigh waves as well as path phase velocity can be affected. The theoretical Love wave spectra is sensitive to both the nature of the low velocity zone and the sediment structure. Thus, observed Love wave spectra do not constrain focal depth. GRA

N76-11625# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
ORIGIN OF PLASTIC DEFORMATION IN OLIVINE AND PYROXENE Scientific Interim Report
Derek Morrison-Smith, Neville Carter, and Charles Prewitt 1 Sep. 1974 11 p refs
(Contract F19628-73-C-0037; AF Proj. 8607)
(AD-A011701; AFCRL-TR-74-0487; SR-1) Avail: NTIS CSCL 08/7

This report describes work initiated under the Contract in which it was proposed to study the slip systems in olivine and pyroxenes using electron microscopy, determine the high temperature crystal structures of these minerals and with this data model the motion of dislocations through these structures. Using this approach it is hoped to be able to predict which slip systems will predominate under particular temperature and strain rate conditions. GRA

N76-11626# Regis Coll., Weston, Mass.
SATELLITE AND ROCKET EXPERIMENTS AND THEIR FEASIBILITY STUDIES. AURORAL IONOSPHERIC FIELDS AND PLASMA STUDIES Final Report, 1 Aug. 1973 - 31 Jan. 1975
Mukhtar Ahmed, Harold P. Mahon, and Delta DuLong 28 Feb. 1975 60 p
(Contract F19628-74-C-0041; AF Proj. 8617)
(AD-A011710; AFCRL-TR-75-0184) Avail: NTIS CSCL 04/1

This report covers studies of the global morphology of ionization in the altitude region 500 to 10,000 km in the low, middle, and polar latitude regions and studies of electric field in the high latitude region to investigate the physical processes operating during quiescent magnetic conditions and during geophysically disturbed periods. GRA

N76-11627# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
GEOMAGNETIC FORECASTING BASED ON EUV CORONAL INTENSITY
Larry J. Gardner Apr. 1975 28 p refs
(COM-75-10727/6; NOAA-TR-ERL-320; NOAA-75051407) Avail: NTIS HC $4.00 HC also available from SOD as C55.13: ERL320-SEL-33 CSCL 04A

A physical model is presented that relates coronal EUV intensity to the geomagnetic index, A sub p, when A sub p is less than 30. This model allows the prediction of A sub p with an accuracy of plus or minus 5, an average of 3 days in advance, 60 percent of the time. The correlation coefficient between forecasted and observed A sub p was 0.3 for 514 forecasts. The root-mean-square error of the forecasts was 6.8 which represents an improvement over the current subjective forecasting method. GRA

N76-11628# National Oceanic and Atmospheric Administration, Washington, D.C. Center for Experiment Design and Data Analysis.
PRELIMINARY REPORT ON WIND ERRORS ENCOUNTERED DURING AUTOMATIC PROCESSING OF IFYGL LORAN-C DATA
J. Sullivan and J. Matejceck May 1975 14 p
(COM-75-10908/2; NOAA-TM-EDS-CEDDA-4; NOAA-75060509) Avail: NTIS HC $3.50 CSCL 04B

Upper air winds were measured by tracking rawinsondes over Lake Ontario during the International Field Year for the Great Lakes. The rawinsonde time-delay data, from which winds were computed, contained four primary types of errors. The frequency of errors and the correction procedures are discussed. The most frequent source of error, noisy data presumably generated from sky-wave interference, was corrected entirely by automatic procedures. Also shown is the effect of correction procedures on vertical resolution of the wind data. GRA

N76-11629# Geological Survey, Menlo Park, Calif.
PRINCIPAL FACTS, ACCURACIES, AND SOURCES FOR 2244 GRAVITY STATIONS IN THE TRONA 1 DEGREE x 2 DEGREE SHEET, CALIFORNIA Final Report, 1956 - 1974
Tor H. Nilsen and Rodger H. Chapman 1975 66 p refs
(PB-242459/6; USGS/GD-75/011) Avail: NTIS HC $4.50 CSCL 08E

Principal facts for 2244 gravity stations in the area covered by the Trona 1 degree x 2 degree Sheet are presented in five separate tables. Descriptions of the format, standards, reduction procedures, and base stations used are also provided. The gravity meters used, calibrations of gravity meters, reduction problems, and accuracies of the data are also discussed. Complete Bouguer anomalies are calculated for each gravity station. The data for each gravity station contain alphanumeric digits that indicate the type of station location relative to elevation determination, accuracy of station elevation, accuracy of latitude or horizontal location and determination, and accuracy of the station's observed gravity value relative to its local base stations. A table providing the code for these digits is included. GRA

N76-11630# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Space Science Branch.
TECHNIQUES FOR THE DERIVATION AND EVALUATION OF TRUNCATED GRAVITATIONAL MODELS FOR SPECIAL APPLICATIONS Final Report
George T. Stentz and Haschal L. White May 1975 33 p refs
(AD-A011934; DMAAC-TR-74-001) Avail: NTIS CSCL 08/5

In many applications, it is necessary to use a truncated gravitational model because of limitations in computer hardware and software or mission requirements. Consequently, studies have been performed to evaluate the effect of truncation and also to determine the best method for the derivation of eighth and 12th degree and order gravitational models. Three methods were used for their derivation; truncation by chopping the original more complete model, suppression of parameter corrections for all harmonic coefficients above the desired degree and order, and by not allowing as parameters any gravitational model coefficients above the desired degree and other limitation. The procedures for the derivation and subsequent analysis were applied to both the Department of Defense World Geodetic System 1972 and the 1969 Smithsonian Standard Earth (II) gravitational models. GRA

N76-11631# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
GROWTH OF ICE CRYSTALS ON SOLID SURFACES
P. A. Shumskii Jul. 1975 43 p refs Transl. into ENGLISH from the monograph "Voprosy Geologii Azii" Moscow, 1955 p 565-595
(AD-A012116; CRREL-TL-483) Avail: NTIS CSCL 08/12

This report discusses the general problem of the growth of crystals. It includes a short history of the phenomenon of accumulation of ice crystals. The processes of the structural formation of a polycrystalline unit are discussed. The theory of a passive orienting influence of a surface on growing crystals is considered. GRA

N76-11632# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
FUNDAMENTAL ATOMIC MECHANISMS IN THE POLAR

CAP Final Report, 1 Jul. 1974 - 31 Mar. 1975
Alex E. S. Green 1 Apr. 1975 99 p refs
(Contract F19628-75-C-0022; AF Proj. 7661)
(AD-A011705; AFCRL-TR-75-0201; FR-11) Avail: NTIS CSCL 04/1

The detailed atomic cross section (DACS) approach to proton energy deposition in N2 is extended by calculations of angular differential elastic cross sections for proton and hydrogen atom impact below 1 keV. These cross sections serve as a necessary input to Monte Carlo computations of the spatial aspect of the proton energy deposition. A detailed comparison of Monte Carlo and continuous slowing down approximation methods has been carried out to determine the importance of the stochastic and discrete nature of the energy loss process for protons at energies of 1 keV and lower. The comparison considers the gross features such as the efficiency for the excitation of a given state of N2 as well as more detailed features such as the spatial distribution for the rate of excitation of a given state. The detailed nature of the Monte Carlo model used allows the determination of the proton and hydrogen atom differential flux as a function of position. Analytical representations of these flux components provide a simple means for the transmission of the vast amount of data generated in the Monte Carlo computations. GRA

N76-11633# Textron, Inc., Buffalo, N.Y. Bell Aerospace Div.
MESA ACCELEROMETER FOR ATMOSPHERE EXPLORER SATELLITES Final Report, 17 Sep. 1971 - 15 Jan. 1975
William G. Lange 15 Jan. 1975 42 p
(Contract F19628-72-C-0096; AF Proj. 6690)
(AD-A011932; Rept-6273-928034; AFCRL-TR-75-0204) Avail: NTIS CSCL 04/1

The report describes development fabrication and test of the MESA accelerometer experiment for use in the Atmosphere Explorer Satellite series over the period 17 September 1971 through 15 January 1975. A total of three, 3 Axis accelerometer experiment packages and two sets of Ground Support Equipment were delivered to AFCRL. The first experiment was placed in orbit on C Atmosphere Explorer satellite in December 1973. The second two experiments have been integrated with the D and E spacecraft, which are scheduled for launch during the late half of 1975. The C spacecraft remains in orbit at this date. Data received thus far, indicate the experiment is operating as predicted. The MESA experiment is designed to measure atmospheric density over the entire altitude range expected in the Atmosphere Explorer series. In addition, it will also measure satellite acceleration from the Orbital Adjust Propulsion System (OAPS). GRA

N76-11634# Pattern Analysis and Recognition Corp., Rome, N.Y.
BURIED LINE SENSOR: WINTER TEST PROGRAM 1973 - 1974. SOFTWARE DOCUMENTATION Final Technical Report
Donald H. Foley, Joseph Wing-Fat Wong, and Dennis D. White May 1975 42 p refs
(Contract F30602-74-C-0122)
(AD-A011731; RADC-TR-75-132) Avail: NTIS CSCL 17/10

This report describes the Analog-to-Digital conversion routines used for creating the hardcopy Library from the data collected during the Winter Test Program for Buried Line Sensors. These A/D routines created the digital data in a format compatible with the Waveform Processing System (WPS) available at RADC. The WPS was then used to annotate the data and produce hardcopies. GRA

N76-11635# California Univ., San Diego. Dept. of Applied Physics and Information Science.
TOPSIDE IONOSPHERE Final Report, Nov. 1972 - Jul. 1974
Peter M. Banks and Robert W. Schunk Aug. 1974 8 p
(Contract N00014-69-A-0200-6042; ARPA Order 2266)
(AD-A012353) Avail: NTIS CSCL 04/1

Behavior of ion velocity distributions for a simple collision model, transport equations for aeronomy, and temperature and density structure of thermal proton flows are briefly reviewed. GRA

N76-11636# Naval Research Lab., Washington, D.C.
VERTICAL DISTRIBUTION OF WATER VAPOR AND ZONE OVER WASHINGTON, D. C. DURING 1971 THROUGH 1973 Final Report
H. J. Mastenbrook and D. R. Purdy 20 May 1975 173 p refs
(AD-A011424; NRL-7884) Avail: NTIS CSCL 04/1

Measurements of the vertical distribution of water vapor and ozone in the stratosphere at heights to 100,000 feet have been obtained at approximately 1-month intervals at a site near Washington, D.C. Data obtained during 1971 through 1973 are presented in tables and graphs. GRA

N76-11637# Terraspace, Inc., Rockville, Md.
CORRELATION OF DATA ON LIQUID JET CUTTING OF ROCKS AND OTHER MATERIALS Final Report, Mar. 1973 - Dec. 1974
William C. Cooley Jan. 1975 57 p refs
(Grant NSF GI-37194)
(PB-242733/4; TR-407-1; NSF/RA/T-74-008) Avail: NTIS HC $4.50 CSCL 13B

A method was developed using dimensionless parameters to correlate data on the depth of slots cut in materials by traversing high pressure continuous liquid jets. It is a generalization of an equation presented by Nikonov and Goldin for application to rocks and coal. In addition to the effect of jet pressure and traverse velocity, it permits taking account of the jet and material densities, standoff distance from the nozzle to the material surface, and the nozzle discharge coefficient. The effect on jet coherence of nozzle Reynolds number and the effect of turbulence and vorticity produced by the feed system at the inlet of experimental nozzles were not included, although they are believed to be significant factors. GRA

N76-11488* Puget Sound Univ., Tacoma, Wash.
SEASAT AND POLAR ICE
W. J. Campbell *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 45-46 (For availability see N76-11482 02-42)
CSCL 08L

N76-11489* Naval Research Lab., Washington, D.C.
GEODETIC CORRECTIONS AND RELATED INFORMATION FROM OCEANOGRAPHIC MEASUREMENTS MADE BY SEASAT-A
Davidson Chen *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 47-49 refs (For availability see N76-11482 02-42)
CSCL 08E

N76-11490* National Oceanic and Atmospheric Administration, Rockville, Md.
SCIENTIFIC VALUE OF SEASAT FOR GEODESY
Bernard H. Chovitz *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 50-53 refs (For availability see N76-11482 02-42)
CSCL 08E

N76-11503* Naval Weapons Lab., Dahlgren, Va.
POTENTIAL CONTRIBUTIONS OF SEASAT-A TO GEODETIC SCIENCE
Samuel L. Smith, III *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 124-125 (For availability see N76-11482 02-42)
CSCL 08E

N76-11507* Army Cold Regions Research and Engineering Lab., Hanover, N.H.
SEASAT AND FLOATING ICE
W. F. Weeks *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 134-135 (For availability see N76-11482 02-42)
CSCL 08L

N76-11510 Joint Publications Research Service, Arlington, Va.
APPLICATION OF SPACE SURVEY MATERIALS IN SOLVING THEORETICAL AND PRACTICAL PROBLEMS IN GEOLOGY
V. N. Bryukhanov, V. K. Yeremin, V. I. Makarov, G. V. Makhin, B. N. Mozhayev, V. G. Trifonov, and P. V. Florenskiy *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 3-15 refs Transl. into ENGLISH from Issled.

Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 13 p (For availability see N76-11509 02-42)

N76-11650 Nairobi Univ. (Kenya).
SOIL FROST PHENOMENA IN THE HIGH MOUNTAINS OF EAST AFRICA
S. Hastenrath *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 81-85 refs (For availability see N76-11640 02-47)
Copyright.

N76-11653 Strathclyde Univ., Glasgow (Scotland). Dept. of Applied Physics.
SOIL MOISTURE AND ITS MEASUREMENT
T. Woodhead *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 97-100 refs (For availability see N76-11640 02-47)
Copyright.

N76-11654 Kenya National Agricultural Labs., Nairobi.
SUMMARY OF DISCUSSIONS ON SOIL CHARACTERISTICS
N. N. Nyandat *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 102-103 (For availability see N76-11640 02-47)
Copyright.

N76-11922 Joint Publications Research Service, Arlington, Va.
INVESTIGATIONS OF PHYSICS OF THE UPPER ATMOSPHERE AND METEOROLOGICAL INVESTIGATIONS
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 52-73 Transl. into ENGLISH from the book "Kosmicheski Issledovaniya Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 22 p (For availability see N76-11919 02-88)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-11638*# City Coll. of the City Univ. of New York.
INVESTIGATION OF MODELS FOR LARGE-SCALE METEOROLOGICAL PREDICTION EXPERIMENTS Final Technical Report
Jerome Spar 31 Oct. 1975 15 p refs
(Grant NGR-33-013-086)
(NASA-CR-145628) Avail: NTIS HC $3.50 CSCL 04B

The feasibility of extended and long-range weather prediction by means of global atmospheric models was studied. A number of computer experiments were conducted at GISS with the GISS global general circulation model. Topics discussed include atmospheric response to sea-surface temperature anomalies, and monthly mean forecast experiments with the global model.
Author

N76-11639*# Physical Dynamics, Inc., Berkeley, Calif.
A FEASIBILITY STUDY FOR THE DETECTION OF UPPER ATMOSPHERIC WINDS USING A GROUND BASED LASER DOPPLER VELOCIMETER Final Report
J. Alex Thomson and J. C. S. Meng Mar. 1975 165 p refs
(Contract NAS8-28984)
(NASA-CR-144041; PD-75-042) Avail: NTIS HC $6.75 CSCL 14B

A possible measurement program designed to obtain the information requisite to determining the feasibility of airborne and/or satellite-borne LDV (Laser Doppler Velocimeter) systems is discussed. Measurements made from the ground are favored over an airborne measurement as far as for the purpose of determining feasibility is concerned. The expected signal strengths for scattering at various altitude and elevation angles are examined; it appears that both molecular absorption and ambient turbulence degrade the signal at low elevation angles and effectively constrain the ground based measurement of elevation angles exceeding a critical value. The nature of the wind shear and turbulence to be expected are treated from a linear hydrodynamic model - a mountain lee wave model. The spatial and temporal correlation distances establish requirements on the range resolution, the maximum detectable range and the allowable integration time.
Author

N76-11640# World Meteorological Organization, Geneva (Switzerland).
AGROCLIMATOLOGY OF THE HIGHLANDS OF EASTERN AFRICA
1974 269 p refs Proc. of the FAO/UNESCO/WMO Tech. Conf., Nairobi, Kenya, 1 - 5 Oct. 1973
(WMO-389; ISBN-92-63-10389-5) Avail: NTIS HC $9.00

Lectures and discussions on the basic meteorological characteristics and physical resources of the area, the general circulation and seasonal weather patterns, rain distribution and probabilities, energy budgets, soil characteristics, water budgets, and biometeorological studies of the main crops grown in the area are presented. For individual titles, see N76-11641 through N76-11667.

N76-11641 World Meteorological Organization, Geneva (Switzerland).
BACKGROUND, AIMS AND PROGRAMME OF THE CONFERENCE
C. M. Taylor *In its* Agroclimatol. of the Highlands of Eastern Africa 1974 p 1-4 (For availability see N76-11640 02-47)
Copyright.

The background of the FAO/UNESCO/WMO Interagency Agroclimatology Project is outlined, and the studies so far undertaken are briefly described. The aim of the present conference, namely to promote the development of the application of meteorology to agriculture, is briefly discussed together with the emphasis of the program.
ESA

N76-11642 Meteorological Office (Gt. Brit.).
SOME NOTES ON THE GENERAL CIRCULATION OF THE ATMOSPHERE AND SEASONAL WEATHER PATTERNS OF EASTERN AFRICA
J. Findlater *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 5-14 refs (For availability see N76-11640 02-47)
Copyright.

The parameters relating to the atmospheric circulation and seasonal weather patterns over East Africa are described. In particular the rainfall features and the effect of the varied highland topography are considered.
ESA

N76-11643 Dar-es-Salaam Univ. (Tanzania).
THE INFLUENCE OF ASPECT AND ELEVATION ON DAILY RAINFALL: SOME EXAMPLES FROM TANZANIA
S. Nieuwolt *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 16-29 refs (For availability see N76-11640 02-47)
Copyright.

The effects of aspect and elevation on diurnal and seasonal rainfall in the highlands of Tanzania are estimated by comparing stations in the same general climate zone. It is shown that the amount and continuity of rainfall is dependent on both factors and that the aspect has a considerable influence on seasonal rainfall distribution while the elevation has little influence.
ESA

N76-11644 East African Meteorological Dept., Nairobi (Kenya).
PROCESSING AND DISTRIBUTION OF RAINFALL DATA
E. Nyoni *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 30-39 refs (For availability see N76-11640 02-47)
Copyright.

The role played by the East African Meteorological Department in the collection, processing and dissemination of rainfall data from over 2000 stations in East Africa is described.
ESA

N76-11645 East African Inst. of Meteorological Training and Research, Nairobi (Kenya).
SUMMARY OF DISCUSSIONS ON RAINFALL
H. T. Moerth *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 40-43 (For availability see N76-11640 02-47)

Copyright.

The papers and ensuing discussions on the factors influencing rainfall in East Africa are summarized. The role of the Intertropical Convergence Zone in the production and seasonal movement of rain is considered. ESA

N76-11646 East African Agricultural and Forestry Research Organization, Muguga (Kenya).
SIGNIFICANCE OF SOLAR RADIATION AND PHOTOPERIODISM
F. J. Wangati *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 44-47 refs (For availability see N76-11640 02-47)
Copyright.

Solar radiation is discussed as a source of light and heat energy as it affects the highlands of East Africa. ESA

N76-11647 World Meteorological Organization, Geneva (Switzerland).
HEAT STRESS IN INDIGENOUS CATTLE **c51**
V. A. Finch *In its* Agroclimatol. of the Highlands of Eastern Africa 1974 p 48-55 refs (For availability see N76-11640 02-47)
Copyright.

The heat stress from solar radiation in zebu cattle (Bos indicus) in the highlands of East Africa was assessed by evaluating the absorption of radiant energy flux, the metabolic heat production and each mode of heat dissipation. The results suggest that heat stress in zebu cattle is minimal and that production is not hindered by solar radiation. ESA

N76-11648 Food and Agriculture Organization of the United Nations, Rome (Italy).
MEASUREMENTS AND CALCULATIONS OF SOLAR AND NET RADIATION **c43**
D. Rijks *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 56-69 refs (For availability see N76-11640 02-47)
Copyright.

Solar radiation and its importance to photosynthesis and crop production is discussed. The components of the radiation balance are noted, and instruments for measuring solar and net radiation are described. Calculations in the absence of measurements are also considered. ESA

N76-11649 East African Meteorological Dept., Nairobi (Kenya).
AGROMETEOROLOGICAL ASSESSMENT OF TEMPERATURE CONDITIONS
A. V. Todorov and J. Pali-Shikhulu *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 70-80 (For availability see N76-11640 02-47)
Copyright.

The two approaches to the agrometeorological assessment of the temperature conditions of a country are discussed. Considerations of the use of various meteorological parameters and a brief general assessment of the temperature conditions in East Africa are given. The extreme and mean air temperatures are discussed together with the diurnal temperature range. It is shown that East Africa possesses vast thermal resources. ESA

N76-11650 Nairobi Univ. (Kenya).
SOIL FROST PHENOMENA IN THE HIGH MOUNTAINS OF EAST AFRICA **c46**
S. Hastenrath *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 81-85 refs (For availability see N76-11640 02-47)
Copyright.

The types of soil frost phenomena, their destructive effects, their altitudinal and regional distribution in East Africa are discussed. ESA

N76-11651 Strathclyde Univ., Glasgow (Scotland). Dept. of Applied Physics.
ENERGY BALANCE OF CROPS **c44**
T. Woodhead *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 86-92 refs (For availability see N76-11640 02-47)
Copyright.

The water and heat budget for the earth's surface is considered and the heat balance equation for the ground extended to a plant or organism. The transport of heat, momentum, water vapor and carbon dioxide by eddy diffusion is discussed, and methods of estimating the components in flux equations are described. ESA

N76-11652# East African Agricultural and Forestry Research Organization, Muguga (Kenya).
SUMMARY OF DISCUSSIONS OF HEAT AND LIGHT
F. J. Wangati *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 93-95 (For availability see N76-11640 02-47)
Copyright.

A summary of the points noted and discussions of the papers dealing with heat and light in the East African highland is presented. ESA

N76-11653 Strathclyde Univ., Glasgow (Scotland). Dept. of Applied Physics.
SOIL MOISTURE AND ITS MEASUREMENT **c46**
T. Woodhead *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 97-100 refs (For availability see N76-11640 02-47)
Copyright.

The two aspects of soil moisture, water quantity and water availability, are defined and both field and laboratory methods of measuring the soil water content, soil water potential and soil matric potential are discussed. ESA

N76-11654 Kenya National Agricultural Labs., Nairobi.
SUMMARY OF DISCUSSIONS ON SOIL CHARACTERISTICS **c46**
N. N. Nyandat *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 102-103 (For availability see N76-11640 02-47)
Copyright.

Discussions on the color, texture and physical properties of the East African highland soils are summarized, and comments on soil erosion are presented. ESA

N76-11655 Food and Agriculture Organization of the United Nations, Rome (Italy).
MEASUREMENTS OF EVAPOTRANSPIRATION **c43**
D. Rijks *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 105-114 refs (For availability see N76-11640 02-47)
Copyright.

Evapotranspiration is defined, and its importance to farming in Africa is assessed. Methods of measuring evapotranspiration by deduction and directly are described, and its calculation when measurements cannot be made is discussed. ESA

N76-11656 Strathclyde Univ., Glasgow (Scotland). Dept. of Applied Physics.
POTENTIAL EVAPOTRANSPIRATION CALCULATIONS AND THEIR USE IN IRRIGATION **c43**
T. Woodhead *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 115-119 refs (For availability see N76-11640 02-47)
Copyright.

The calculation of potential evapotranspiration by various methods is described. The use and precision of evapotranspiration estimates is discussed especially in relation to irrigation. ESA

N76-11657 Field Science Office for Africa, Nairobi (Kenya).
NATURE CONSERVATION AND WATER RESOURCES: ASPECTS OF THE HIGHLANDS OF EASTERN AFRICA **c43**
Kai Curry-Lindahl *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 120-131 refs (For availability see N76-11640 02-47)
Copyright.

The environmental conditions governing the water resources of the highlands of east Africa are described. The impact of crop cultivation on the highlands is considered, and the extent to which this threatens the water resources as well as the

other natural renewable resources such as soil, vegetation, and wild animals is discussed. ESA

N76-11658 East African Agricultural and Forestry Research Organization, Muguga (Kenya).
THE WATER BALANCE OF CATCHMENTS IN THE HIGHLANDS OF KENYA **c43**
K. A. Edwards *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 132-151 refs (For availability see N76-11640 02-47)
Copyright.

The major water balance problems of the Kenyan highlands are identified, and the need and design of water catchment areas are discussed. The sources for the catchment such as rainfall, runoff, evaporation, soil moisture and ground water are considered together with methods of calculating the yield. The operation of a network of catchments is noted. ESA

N76-11659 Haile Sellassie Univ., Addis Ababa (Ethiopia). Dept. of Plant Sciences.
AGROCLIMATOLOGY OF TEFF IN ETHIOPIA
Tsegazeab Woldetatios *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 152-160 refs (For availability see N76-11640 02-47)
Copyright.

The characteristics and uses of Teff Eragrostis Teff (Zucc.) Trotter are described followed by the general climatic condition in Ethiopia. The moisture and temperature effects on the agronomic performance of teff in the Ethiopian highlands are discussed. ESA

N76-11660 National Agricultural Research Station, Kitale (Kenya).
MAIZE PRODUCTION TRENDS IN KENYA AND THE INFLUENCE OF SEASONAL RAINFALL VARIATIONS ON OUTPUT **c43**
A. Y. Allan *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 161-168 refs Sponsored by Overseas Develop. Admin. (For availability see N76-11640 02-47)
Copyright.

The problems of estimating the annual production of maize in Kenya are discussed. Causes for the seasonal fluctuation in crop yields are considered, and a method for predicting future production is suggested. ESA

N76-11661 National Agricultural Research Station, Kitale (Kenya).
SOIL PHYSICAL CONDITIONS UNDER MAIZE **c43**
P. J. M. Cooper *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 169-186 refs Sponsored by Overseas Develop. Admin. (For availability see N76-11640 02-47)
Copyright.

The effect of soil temperature, soil moisture, and soil aeration on the production and yield of maize in Kenya is discussed. Methods for measuring the three parameters are described, and results of measurements are tabulated. Tentative conclusions are drawn. ESA

N76-11662 National Agricultural Research Station, Kitale (Kenya).
PRELIMINARY FINDINGS OF A STUDY OF THE GROWTH OF MAIZE IN KENYA **c43**
R. Law *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 187-196 refs Sponsored by Overseas Develop. Admin. (For availability see N76-11640 02-47)
Copyright.

Results of experiments conducted at NARS, Kitale, Kenya on the growth patterns of maize varieties, and the effect of the time of planting on the growth pattern are discussed. Factors causing reduced yields in late planted maize are analyzed, and it is tentatively concluded that soil temperature may be a critical factor governing crop growth. ESA

N76-11663 East African Meteorological Dept., Nairobi (Kenya).
AGROCLIMATOLOGY OF WHEAT
J. Pali-Shikhulu *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 197-202 (For availability see N76-11640 02-47)
Copyright.

The main factors to be considered in the introduction and successful production of wheat in East Africa are discussed. The heat and water requirements of wheat are reviewed and typical diseases of wheat described. The possibility of using meteorological data to predict epidemics of cereal rusts is noted. ESA

N76-11664 Coffee Research Station, Ruiru (Kenya).
THE EFFECT OF WEATHER CONDITIONS ON INFECTION BY COFFEE BERRY DISEASE
R. T. A. Cook *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 203-313 refs (For availability see N76-11640 02-47)
Copyright.

The incidence of Coffee Berry Disease (CBD) caused by the fungus Collectrichum colleanum is dependent on periods of wetness, the effect of temperature on the disease is not clear. Conflicting opinions of the temperature role were tested against accurate data on CBD infection collected over the last eight years at the Coffee Research Station at Ruiru, Kenya. The results are presented and discussed and the evidence suggests that temperature can be discounted as a limiting factor in CBD infection thus making outbreaks of the disease easier to predict. ESA

N76-11665 Research Inst. of East Africa, Kericho (Kenya).
COMMENTS ON THE SECTION ON TEA OF THE AGROCLIMATOLOGY REPORT
D. H. Laycock and C. O. Othieno *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 214-224 refs (For availability see N76-11640 02-47)
Copyright.

The growth of the tea bush in relation to the weather is discussed. The rainfall, transpirational and soil requirements of tea in a number of countries are examined and the role played by shade and temperature is considered. ESA

N76-11666 East African Meteorological Dept., Nairobi (Kenya).
TRAINING IN AGRICULTURAL METEOROLOGY: THE OPERATIONAL VIEWPOINT **c81**
R. C. Hills *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 225-232 refs (For availability see N76-11640 02-47)
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The basic requirements for the various grades of meteorologist are considered together with likely duties. The problems in training agricultural meteorologists that have become apparent in organizing operational services are identified. ESA

N76-11667 East African Meteorological Dept., Nairobi (Kenya).
TRAINING IN AGROMETEOROLOGY IN EAMD **c81**
A. V. Todorov *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 232-240 (For availability see N76-11640 02-47)
Copyright.

The aims, tasks and needs of the East African Meteorological Department are outlined and the requirements for training the three groups of agrometeorological personnel needed to carry out these tasks are discussed. ESA

N76-11668# Ludwig-Maximilians-Universitat, Munich (West Germany). Inst. fuer Meteorologie.
VARIATIONAL CLIMATOLOGY IN THE FREQUENCY AND TIME DOMAIN [SCHWANKUNGSKLIMATOLOGIE IM FREQUENZ- UND ZEITBEREICH]
Christian-Dietrich Schoenwiese Aug. 1974 139 p refs In GERMAN; ENGLISH summary
(Mitt-24) Avail: NTIS HC $6.00

Climatic changes were analyzed by using Tukey's method of calculating power spectra and bandpass filtering of time series data. 54 series of air temperature and precipitation data covering the years 1781 to 1965 show a distribution of variance which is typical for each single station and climatic element. Most of the spectra show significant maxima in regard to certain periodic ranges. There is no sign of a general type of global spectrum. Time bandpass filtering shows that maxima of variance gained from the spectra are not referred to singular accidental events

but to systematical mechanisms, which are able to affect areas of several hundreds of kilometers in exactly the same way. ESA

N76-11669# National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service.
MARINERS WEATHER LOG, VOLUME 19, NUMBER 3, MAY 1975
Elwyn E. Wilson, ed. May 1975 71 p
(COM-75-90008/05; NOAA-75052005) Avail: NTIS HC $4.50; HC also available from Environmental Data Service, Page Bldg. 1 (D762), 2001 Wisconsin Ave., N. W., Washington, D. C. 20235 CSCL 04B

The monthly periodical contains two articles, abstracted separately, and six sections on marine weather conditions. These weather data sections include hints to the observer, tips to the radio officer, Hurricane Alley, on the editor's desk, marine weather review, and marine weather diary. GRA

N76-11670# Illinois State Water Survey, Urbana.
DESIGN OF AN EXPERIMENT TO SUPPRESS HAIL IN ILLINOIS Annual Report
Stanley A. Changnon, Jr., Griffith M. Morgan, Neil G. Towery, and Gary L. Achtemeiier Mar. 1974 47 p refs
(Grant NSF GI-37859)
(PB-242234/3; CR-155; NSF/RA/E-74-063) Avail: NTIS HC $4.00 CSCL 04B

The project is developing the design of a hail suppression experiment in Illinois. There were several scientific accomplishments during the past year. The systems engineering approach for the two-yr project has successfully involved a carefully interlocked series of data gathering and analysis efforts. These together have focused on hailstorm forecasting, hailstorm identification with radar, classification of different storm-producing conditions, and the implications of these on a seeding system that embraces these findings with those of the past six years that addressed evaluation and surface data. GRA

N76-11671# Illinois State Water Survey, Urbana.
METROMEX STUDIES, 1971 - 1973 Annual Report
Bernice Ackerman, Herbert Appleman, Stanley A. Changnon, Jr., Floyd Huff, and Douglas Jones Sep. 1974 194 p refs
(Grant NSF GI-38317)
(PN-242268/1; CR-163; NSF/RA/E-74-062) Avail: NTIS HC $7.50 CSCL 04B

The report summarizes activities and analytical results obtained in conjunction with the 1973 (summer) METROMEX operations concerning urban effects on precipitation and severe weather. Where possible, a summary of results for the three-year period, 1971-73, is presented also. Particular emphasis was placed upon the radar analyses, since 1973 was the first year in which adequate data were collected to aid substantially in delineating the urban effect on precipitation processes. Attention was given to surface air and dewpoint temperature patterns. Results are presented on synoptic analyses of rain events, monthly and storm rainfall, raincells (convective entities), thunderstorms, hailstorms boundary layer studies, clouds, and surface weather for the St. Louis region. GRA

N76-11672# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
GATE CONVECTION SUBPROGRAMME, FIELD PHASE REPORT
Alan K. Betts and David R. Rodenhuis Feb. 1975 113 p refs Sponsored in part by NOAA and NSF
(COM-75-10747/4) Avail: NTIS HC $5.50 CSCL 04A

A summary is given of the in-field decisions affecting the GATE Convection Subprogramme (C.S.P.) objectives. A preliminary tabulation and discussion of the data collection is made, and a discussion of the work of the Special Analysis Group in Dakar is given. Preliminary tables are presented of the upper air data coverage for the B and A/B ship arrays, the C-band ship radars, the SMS satellite coverage and the multi-aircraft missions flown in support of the C.S.P. A preliminary assessment of the subprogramme observational objectives is given. GRA

N76-11673# National Environmental Satellite Service, Washington, D.C.
PUBLICATIONS AND FINAL REPORTS ON CONTRACTS AND GRANTS, NESS - 1974
Apr. 1975 14 p
(COM-75-10850/6; NOAA-TM-NESS-69; NOAA-75052202) Avail: NTIS HC $3.50 CSCL 04B

The memorandum contains lists of articles and reports published for or by the National Environmental Satellite Service (NESS) during 1974. The two categories included are: Publications by staff members of NESS, 1974 and final reports on contracts and grants sponsored by NESS, 1974. Information on ordering copies of these reports is given. Author

N76-11674# Purdue Univ., Lafayette, Ind.
A STUDY OF ATMOSPHERIC VORTEX PHENOMENA ASSOCIATED WITH THE WATERSPOUT Final Report, 1 Jul. 1971 - 31 Mar. 1974
C. R. Church and C. M. Ehresman Dec. 1974 144 p refs
(Grant NOAA-N22-32-72(G))
(COM-75-10872/0; NOAA-75052006) Avail: NTIS HC $6.00 CSCL 04B

The results of field work, sponsored by NOAA, on waterspout dynamics are reported. Various aspects of the measurement system and field operations are described; scientific data and analysis and recommendations for future work are included. In addition to the discussion of main project goals, a number of other aspects of vortex phenomena are covered. GRA

N76-11675# IBM Federal Systems Div., Gaithersburg, Md.
GLOBAL WEATHER MODELING WITH VECTOR SPHERICAL HARMONICS Final Report, 30 Nov. 1973 - 28 Feb. 1975
Sven Biorklund, N. Pleszkoch, and F. Testa 28 Apr. 1975 138 p refs
(Contract F44620-74-C-0036; ARPA Order 2633)
(AD-A011760; AFOSR-75-0674TR) Avail: NTIS CSCL 04/2

A three-dimensional spectral global weather prediction model based on the Mintz-Arakawa model, using vector spherical harmonics has been used for prediction with real data. GRA

N76-11494* National Center for Atmospheric Research, Boulder, Colo.
SATELLITE OBSERVATIONS OF WEATHER AND CLIMATE
William W. Kellogg *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 74-78 refs (For availability see N76-11482 02-42) CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-11676# Joint Publications Research Service, Arlington, Va.
ACOUSTIC METHODS AND FACILITIES FOR INVESTIGATING THE OCEAN, PART 1
16 Oct. 1975 297 p refs Transl. into ENGLISH from Akust. Metody i Sredstva Issled Okeana: Tezisy Dokladov Pervoy Dalnevost Akust. Konf., Chelovek i Okean, Chast 1, Vladivostok, 1-6 Oct. 1974
(JPRS-65947-Pt-1) Avail: NTIS HC $9.25

Reports delivered at the First Far Eastern Acoustic Conference held in October 1974 and related to the investigation of the sea by acoustic equipment and methods are presented. Waveguides signal processing, antenna arrays, wave diffraction, and mathematical models of sound propagation in the ocean are some of the topics discussed. Author

N76-11677*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF TECHNIQUES FOR APPROXIMATING OCEAN BOTTOM TOPOGRAPHY IN A WAVE-REFRACTION COMPUTER MODEL
Lamont R. Poole Washington Nov. 1975 46 p refs
(NASA-TN-D-8050; L-10320) Avail: NTIS HC $4.00 CSCL 08J

A study of the effects of using different methods for approximating bottom topography in a wave-refraction computer

model was conducted. Approximation techniques involving quadratic least squares, cubic least squares, and constrained bicubic polynomial interpolation were compared for computed wave patterns and parameters in the region of Saco Bay, Maine. Although substantial local differences can be attributed to use of the different approximation techniques, results indicated that overall computed wave patterns and parameter distributions were quite similar. Author

N76-11678*# Rhode Island Univ., Kingston. Dept. of Ocean Engineering.

DEVELOPMENT OF A THREE DIMENSIONAL NUMERICAL WATER QUALITY MODEL FOR CONTINENTAL SHELF APPLICATIONS

Malcolm Spaulding and David Hunter [1975] 247 p refs (Grant NsG-1008)
(NASA-CR-145694) Avail: NTIS HC $8.00 CSCL 08J

A model to predict the distribution of water quality parameters in three dimensions was developed. The mass transport equation was solved using a non-dimensional vertical axis and an alternating-direction-implicit finite difference technique. The reaction kinetics of the constituents were incorporated into a matrix method which permits computation of the interactions of multiple constituents. Methods for the computation of dispersion coefficients and coliform bacteria decay rates were determined. Numerical investigations of dispersive and dissipative effects showed that the three-dimensional model performs as predicted by analysis of simpler cases. The model was then applied to a two dimensional vertically averaged tidal dynamics model for the Providence River. It was also extended to a steady state application by replacing the time step with an iteration sequence. This modification was verified by comparison to analytical solutions and applied to a river confluence situation. Author

N76-11679# Naval Postgraduate School, Monterey, Calif.

A HYDROGRAPHIC AND ACOUSTIC SURVEY OF THE PERSIAN GULF, PART 1 M.S. Thesis

Jay Lee Wright Sep. 1974 88 p refs
(AD-A012414) Avail: NTIS CSCL 08/10

A survey of literature and historical data was used to investigate the seasonal variations in the hydrographic and acoustic properties of the Persian Gulf. The Gulf has a year round salinity of about 40 parts per thousand by weight. The surface temperature varies from 30C in summer to 20C in winter. An area of significant importance in the Gulf is near the Strait of Hormuz where the Persian Gulf water encounters the warmer less saline water of the Arabian Sea. Detection ranges for diesel and nuclear submarines were investigated using the FACT acoustic transmission loss model. Generally, ranges appear to be greater in winter due to increased vertical mixing, creating strong positive sound speed gradients. GRA

N76-11680# Environmental Prediction Research Facility (Navy), Monterey, Calif.

A STATISTICAL AND SPECTRAL ANALYSIS OF THE AIR-SEA INTERACTIONS AT OWS NOVEMBER

Kevin Rabe and Robert H. Bourke May 1975 91 p refs
(AD-A011817; ENVPREDRSCHF-Tech-Paper-9-75) Avail: NTIS CSCL 08/3

Oceanographic and meteorological data from Ocean Weather Station (OWS) NOVEMBER were analyzed by statistical and spectral methods in order to describe the nature and periodicities of the air-ocean energy exchange. Salinity data from 1968 through 1970 were compared with daily observed parameters commonly associated with changes in the salinity. Regression analysis showed surface salinity to be highly correlated with surface pressure which is interpreted as the surface salinity responding to a baroclinic transport. Twenty-four years (1947-1970) of daily averaged, observed climatological values, as well as heat exchange terms computed from them, were compared with the sea-surface temperature time series and spectrally analyzed. GRA

N76-11681# Environmental Prediction Research Facility (Navy), Monterey, Calif.

CLASSIFICATION AND ANALYSIS/FORECASTING OF NEAR-SURFACE OCEAN THERMAL STRUCTURE

T. Laevastu May 1975 36 p refs
(AD-A011818; ENVPREDRSCHF-Tech-Paper-14-75) Avail: NTIS CSCL 08/10

The near-surface ocean thermal structure (surface to ca 400 m) is classified into nine distinct types. The time and space distribution of these types is briefly discussed. A rational method for analysis/prediction of mixed layer depth (MLD) and near-surface thermal structure, which has produced satisfactorily verifiable results, is described and flow diagrams for it are given. GRA

N76-11682# National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.

THE OUTER BOUNDARY INTEGRAL EQUATION METHOD APPLIED TO WAVE SCATTERING IN AN INFINITE, LOCALLY INHOMOGENEOUS MEDIUM

Richard Paul Shaw Sep. 1974 67 p refs Prepared in cooperation with Hawaii Inst. of Geophysics
(COM-75-10890/2; NOAA-JTRE-126; NOAA-75061004) Avail: NTIS HC $4.50 CSCL 08C

The scattering of time harmonic and transient waves by an obstacle in a locally inhomogeneous infinite medium, i.e., a medium which becomes essentially homogeneous at some distance from the obstacle, is treated. An artificial outer boundary is drawn within the homogeneous region, and an outer boundary integral equation is used to relate the dependent variable and its normal derivative at this boundary. This in turn is used to complete another set of equations obtained by standard techniques, e.g., finite differences, for the inhomogeneous interior region. Numerical examples are given for water-wave scattering by a circular island surrounded by various locally variable depth topographies. GRA

N76-11683# National Environmental Satellite Service, Washington, D.C.

A SUMMARY OF THE RADIOMETRIC TECHNOLOGY MODEL OF THE OCEAN SURFACE IN THE MICROWAVE REGION

John C. Alishouse Mar. 1975 31 p refs
(COM-75-10849-8; NOAA-TM-NESS-66; NOAA-75052201) Avail: NTIS HC $4.00 CSCL 08J

Between November 1970 and March 1974, studies were pursued to determine sea-surface temperature and roughness from a satellite-borne microwave radiometer. Such factors as salinity, foam, wave spectra, polarization, and atmospheric attenuation were investigated to determine optimum frequencies and accuracy limitations. The resultant model developed is a two-dimensional two-scale model that incorporates upwind and crosswind wave spectra and considers waves that are both large and small in comparison with the radiometer's wavelength. GRA

N76-11684# Physical Sciences, Inc., Wakefield, Mass.

MICROSTRUCTURE ANALYSIS Quarterly Technical Report, 1 Mar. - 1 Jun. 1975

Girard Simons 15 Aug. 1975 25 p refs
(Contract N00014-75-C-0927; ARPA Order 2961)
(AD-A012394; PSI-TR-31) Avail: NTIS CSCL 08/10

Field observations have revealed that the ocean's thermocline possesses an internal structure consisting of a series of thin, laminar sheets of high gradient separated by steps of only moderate density gradient. Various mechanisms have been proposed to explain the observed phenomenon. These mechanisms consist of double diffusion, interleaving, internal gravity wave breaking and internal wave steepening. In this report, the concept of interval wave steepening is examined. The authors first determine the set of admissable wave solutions and then examine the nonlinear coupling. Comparison with field data establishes the feasibility of the wave steepening approach. GRA

N76-11486* National Oceanic and Atmospheric Administration, Princeton, N.J. Geophysical Fluid Dynamics Lab.

MEASUREMENTS OF TRANSIENT CURRENTS IN MID-OCEAN BY ALTIMETRY

Kirk Bryan *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 39-40 (For availability see N76-11482 02-42)
CSCL 08C

N76-11487* National Oceanic and Atmospheric Administration, Miami, Fla.

GEOSTROPHIC CURRENT INVESTIGATIONS WITH SEASAT
H. Michael Byrne and William O. VonArx (Woods Hole Oceanographic Inst.) *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 41-44 (For availability see N76-11482 02-42)
CSCL 08C

N76-11491* Scripps Institution of Oceanography, La Jolla, Calif. Inst. of Geophysics and Planetary Physics.
OCEAN TIDES FROM SEASAT-A
M. C. Hendershott, W. H. Munk, and B. D. Zetler *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 54-56 refs (For availability see N76-11482 02-42)
CSCL 08C

N76-11493* California Univ., Los Angeles.
BENEFITS TO THE STUDY OF OCEANIC TECTONICS EXPECTED FROM SEASAT-A
W. M. Kaula *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 70-73 refs (For availability see N76-11482 02-42)
CSCL 08J

N76-11496* Naval Research Lab., Washington, D.C.
EXPLOITATION OF SEASAT-A OCEANOGRAPHIC MEASUREMENTS FOR NAVY R AND D APPLICATIONS
V. Noble *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 85-88 (For availability see N76-11482 02-42)
CSCL 08J

N76-11497* City Coll. of the City Univ. of New York. Inst. of Oceanography.
THE SCIENTIFIC JUSTIFICATION FOR OBTAINING OCEAN WAVE DATA OF VARIOUS KINDS WITH SEASAT-A
Willard J. Pierson *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 89-94 (For availability see N76-11482 02-42)
(Contract NAS5-20041)
CSCL 08C

N76-11499* Coast Guard, Washington, D.C. Oceanography Unit.
ADVANTAGES OF AN OCEANOGRAPHIC SATELLITE IN THE STUDY OF OCEAN CURRENT SYSTEMS
R. Q. Robe *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 99-100 (For availability see N76-11482 02-42)
CSCL 08C

N76-11500* Naval Research Lab., Washington, D.C.
COMMENTS ON NAVY/NRL REQUIREMENTS FOR SEA SURFACE TEMPERATURE AND SURFACE WIND MEASUREMENTS ON SEASAT-A
R. E. Ruskin and R. K. Jeck, Jr. *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 101-102 (For availability see N76-11482 02-42)
CSCL 08J

N76-11501* Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
ON THE REMOTE SENSING OF DIRECTIONAL WAVE SPECTRA AND SURFACE WINDS
O. H. Shemdin *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 103-108 refs (For availability see N76-11482 02-42)
CSCL 08C

N76-11502* National Environmental Satellite Service, Washington, D.C.
MICROWAVE MEASUREMENT OF SEA SURFACE TEMPERATURE
John W. Sherman, III and P. Kirshna Rao *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 109-123 refs (For availability see N76-11482 02-42)
CSCL 08J

N76-11504* Scripps Institution of Oceanography, La Jolla, Calif.
SATELLITE MEASUREMENTS OF OCEAN WAVES
Robert H. Stewart *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 126-127 ref (For availability see N76-11482 02-42)
CSCL 08C

N76-11505* Florida State Univ., Tallahassee.
PHYSICAL OCEANOGRAPHY FROM SATELLITES: CURRENTS AND THE SLOPE OF THE SEA SURFACE
W. Sturges *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 128 refs (For availability see N76-11482 02-42)
CSCL 08J

N76-11514 Joint Publications Research Service, Arlington, Va.
FUTURE POSSIBILITY OF INVESTIGATING THE OCEAN USING ARTIFICIAL SATELLITES
K. N. Fedorov and V. Ye. Sklyarov *In its* Exploration of Earth Resources by Space Methods (JPRS-65858) 6 Oct. 1975 p 36-48 refs Transl. into ENGLISH from Issled. Zemnykh Resursov Kosmich. Sredstvami (Moscow), no. 2, 1975 13 p (For availability see N76-11509 02-42)

N76-11817* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACTIVE MICROWAVE REMOTE SENSING OF OCEANS, CHAPTER 3
In its Active Microwave Workshop Report 1975 p 157-162 (For availability see N76-11811 02-70)
CSCL 08J

N76-11819* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LOCAL PHENOMENA, CHAPTER 3, PART C
In its Active Microwave Workshop Report 1975 p 181-191 (For availability see N76-11811 02-70)
CSCL 08J

N76-11820* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE-SCALE PHENOMENA, CHAPTER 3, PART D
In its Active Microwave Workshop Report 1975 p 192-220 (For availability see N76-11811 02-70)
CSCL 08J

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-11685*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
EVALUATION OF THE ENERGY EXPENDED IN A LEARNING SITUATION (CONDITIONING BASED ON FOOD REINFORCEMENT) BY GOLDFISH (CARASSIUS AURATUS L.)
Michel Anthouard Washington NASA Nov. 1975 10 p refs Transl. into ENGLISH from Bull. of the Soc. Zoologique de France (Paris), v. 97, no. 2, 1972 p 205-210
(Contract NASw-2789)
(NASA-TT-F-16650) Avail: NTIS HC $3.50 CSCL 06C

The behavior of fish is studied when placed in a learning situation. It is demonstrated that fish work much more often by pushing than by pulling; moreover, the latter procedure was found to be less efficient. Individual variations observed within the group listed make it possible to envisage the possibility of comparative analysis on the behavior of fish subjected to conditioning, which may result in a characterological study. The results obtained here constitute a basis for evaluating the effect of environmental factors (social or non-social) on attainment.
Author

N76-11686*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
FASTING AND RENOURISHMENT OF CARP (CYPRINUS CARPIO L.), 3
G. Bouche, J. F. Narbonne, and A. Serfaty Washington NASA Nov. 1975 11 p refs Transl. into ENGLISH from Arch. Sci. Physiol. (Paris), v. 26, 1972 p 101-109
(Contract NASw-2789)
(NASA-TT-F-16651) Avail: NTIS HC $3.50 CSCL 06C

The effect of artificial complete fasting of carp on variations of their content of polysomal and ribosomal RNA, as well as of soluble RNA, was investigated. This effect was ascertained by

separately weighing the specimens and their livers, as well as by chemical spectrophometric analysis. A comparison was made of the results obtained for carp which were subjected to artificial fasting followed by renourishment with two separate diets, with those of a control group. Natural seasonal effects were simulated during these experiments. It was found that artificial complete fasting of carp results in major losses in polysomal and ribosomal RNA, while the losses in soluble RNA were less severe. The hepatocytes of renourished carp contained more ribosomal, polysomal, and soluble RNA than normally nourished carp. The mortality rate of renourished carp depended on the type of diet. Author

N76-11687*# Kanner (Leo) Associates, Redwood City, Calif.
LOCALIZATION OF 3H-GAMMA-AMINOBUTYRIC ACID IN THE COCHLEA. LIGHT AND ELECTRON MICROSCOPIC AUTORADIOGRAPHY
W. Richrath, H. Kraus, and H. G. Fromme Washington NASA Nov. 1975 15 p refs Transl. into ENGLISH from Arch. Oto-rhino-Laryng. (West Ger.), v. 208, 1974 p 283-293
(Contract NASw-2790)
(NASA-TT-F-16661) Avail: NTIS HC $3.50 CSCL 06R

Autoradiograms of quinea pig cochleae and brains were examined microscopically after administration of 3H-GABA to determine its distribution from the grain density. A blood perilymph barrier in addition to the blood brain barrier was suggested by a lack of activity in brain and cochlea after intraarterial injection. Cochlear perfusion produced considerable labeling in the spiral ganglion. 3H-GABA activity was only indicated above glia cells, but not above nerve cell bodies or axons. Light microscopy showed selective labeling at efferent nerve fibers in Corti's organ; only labeling of efferent synapses was found electron microscopically. Silver grains were predominantly above vesicles and mitochondria. Afferent synapses were unlabeled. It is concluded that the efferent system of Corti's organ contains a high degree of GABA, but contradicting previous electrophysical results make it impossible to determine at this time that the substance is a transmitter. Author

N76-11688*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
CHLORPROMAZINE, PIRACETAM, AND THE METABOLISM OF BRAIN PHOSPHOLIPIDS IN THE RAT
L. Rochus and J. J. Reuse Washington NASA Nov. 1975 6 p refs Transl. into ENGLISH from Compt. Rend. Soc. Biol. (Masson), v. 166, no. 6-7, 1972 p 975
(Contract NASw-2789)
(NASA-TT-F-16652) Avail: NTIS HC $3.50 CSCL 06C

The effects of chlorpromazine, piracetam, and their possible interaction on the incorporation of radioactively labeled phosphate in the total phospholipids, as well as in various phospholipidic fractions, of the cerebral cortex of the rat was investigated in vivo. Three different types of experiments were carried out. The first group of rats was injected intraperitoneally with chlorpromazine only, the second group with piracetam only, and the third group with both. The corresponding effects on the incorporation of P-32 in the phospholipids of the cerebral cortex are presented quantitatively in tabular form. The results show that chlorpromazine decreases the incorporation of P-32. Moreover, while piracetam by itself has little effect, when used in combination with chlorpromazine, it may significantly augment the depressive effect of the latter. Author

N76-11689*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
INFLUENCE OF Zsub 1210 CELL GROWTH OF CELLS STERILIZED BY IONIZING RADIATIONS
E. P. Malaise, Z. Detcheva-Ninova, and M. Tubiana Washington NASA Nov. 1975 6 p refs Transl. into ENGLISH from Compt. Rend. Acad. Bulgare Sci. (Sofia), v. 28, no. 3, 1975 p 427-429
(Contract NASw-2789)
(NASA-TT-F-16538) Avail: NTIS HC $3.50 CSCL 06M

Experiments concerning the influence of sterilized cells on L sub 1210 cell growth were performed. Mice were injected either subcutaneously or intra-peritoneally with certain cells; some were also previously exposed to radiation. Tumor growth was monitored as well as the survival periods of the mice after injection. Author

N76-11690*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
MOLECULAR MEMORY?
A. Pfeiffer Washington NASA Nov. 1975 9 p refs Transl. into ENGLISH from Studia Biophysica (Berlin), v. 46, no. 2, 1974 p 131-136
(Contract NASw-2789)
(NASA-TT-F-16654) Avail: NTIS HC $3.50 CSCL 06P

An explanation for the partially contradictory results of chemical examination of certain conditioned reflexes in animals is given, which rests on the assumption of a chemical specificity of the connector substances within the synaptic terminals of axons of varying origin, and which are thought to be effective during the learning process, as opposed to the assumption of a chemical structure of these substances which would be dependent on a memory content requiring individual definition in each case. Author

N76-11691*# Martin Marietta Corp., Houston, Tex. Aerospace Group.
INTEGRATED LIFE SCIENCES TECHNOLOGY UTILIZATION DEVELOPMENT PROGRAM Final Report, 1 Jun. 1974 - 10 Oct. 1975
Oct. 1975 34 p
(Contract NAS9-14215)
(NASA-CR-144545) Avail: NTIS HC $4.00 CSCL 06B

The goal of the TU program was to maximize the development of operable hardware and systems which will be of substantial benefit to the public. Five working prototypes were developed, and a meal system for the elderly is now undergoing evaluation. Manpower utilization is shown relative to the volume of requests in work for each month. The ASTP mobile laboratories and post Skylab bedrest study are also described. Author

N76-11692*# Harvard Univ., Cambridge, Mass.
M-071 CRITICAL DATA ANALYSIS Final Technical Report, 27 Jun. 1973 - 31 Dec. 1975
D. M. Hegsted 31 Dec. 1975 122 p refs
(Contract NAS9-13370)
(NASA-CR-145692) Avail: NTIS HC $5.50 CSCL 06S

A prototype balance study was conducted on earth prior to the balance studies conducted in Skylab itself. Collected were daily dietary intake data of 6 minerals and nitrogen, and fecal and urinary outputs on each of three astronauts. Essential statistical issues show what quantities need to be estimated and establish the scope of inference associated with alternative variance estimates. The procedures for obtaining the final variability due both to errors of measurement and total error (total = measurement and biological variability) are exhibited. Author

N76-11693# Advisory Group for Aerospace Research and Development, Paris (France).
RADIATION HAZARDS
Aug. 1975 149 p refs Presented at a Lecture Series in The Netherlands, 22-23 Sep. 1975, Germany, 25-26 Sep. 1975, and Norway, 29-30 Sep. 1975 Sponsored by the Aerospace Med. Panel and the Consultant and Exchange Programme of AGARD
(AGARD-LS-78) Avail: NTIS HC $6.00

There has been a remarkable development and increase in the number of processes and devices that utilize or emit non-ionizing radiation which includes ultra-violet, visible light, infrared, microwave, radiofrequency, ultrasound. This series provides a scientifically accurate, authoritative review and critical analysis of the available information and concepts to give a basis for informed judgements and judicious application of these energies for maximal benefit and minimum risk or hazard to man. For individual titles, see N76-11694 through N76-11704.

N76-11694 Rochester Univ., N.Y. School of Medicine and Dentistry.
PATHOPHYSIOLOGIC ASPECTS OF EXPOSURE TO MICROWAVE **c52**
Sol M. Michaelson *In* AGARD Radiation Hazards Aug. 1975 7 p refs (For availability see N76-11693 02-51)

Body temperature increase during exposure to microwaves is explored. Awareness of microwave exposure is developed by several mechanisms, including cutaneous thermal sensation or pain. Cataracts were produced in some experimental animals,

primarily rabbits, when the eyes were directly exposed to rather high power density of microwaves over periods ranging from several minutes to hours. Microwave effects on the tests was studied, along with chromosome changes, hematopoiesis, and cardiovascular effects. J.A.M.

N76-11695 Bristol General Hospital (England).
PHYSICAL ASPECTS - ULTRASOUND **c71**
B. N. T. Wells *In* AGARD Radiation Hazards Aug. 1975 7 p refs (For availability see N76-11693 02-51)

Ultrasound, which is a form of energy consisting of mechanical vibrations the frequencies of which lie above the range of human hearing, travels through media in the form of waves. At frequencies of tens to hundreds of kilohertz, ultrasound may be generated and detected by magnetostriction; at higher frequencies, piezoelectric, and particularly ferroelectric, transducers are used. At megahertz frequencies, ultrasonic powers are most conveniently measured by radiation pressure detectors, or by calorimetry. In biological soft tissues, ultrasonic waves are usually in the longitudinal mode, and travel at velocities of around 1 500 m/s. The shape of ultrasonic field depends on the size of the transducer in relation to the wavelength. Focusing systems of quite small dimensions can be used to produce high intensities at megahertz frequencies. Specular reflection occurs at discontinuities in characteristic impedance which are large in relation to the wavelength; energy is scattered by smaller discontinuities within biological materials. Author

N76-11696 Washington Univ., Seattle. Bioelectromagnetics Research Lab.
BIOPHYSICS - ENERGY ABSORPTION AND DISTRIBUTION **c52**
Arthur W. Guy *In* AGARD Radiation Hazards Aug. 1975 14 p refs (For availability see N76-11693 02-51)

The interpretation of the biological effects observed in tissues exposed to EM fields requires a complete quantitative description of the fields within the tissues. These fields are complex functions of the source configuration, shape and size of the exposed subject, and the frequency. The average and maximum absorbed power density may vary over many orders of magnitude for the same applied field intensities. Depending on conditions, power absorption may be predominantly at the surface of the subject or may be affecting only superficial tissues in the interior of the subject affecting deep tissues. Author

N76-11697 Air Force Systems Command, Brooks AFB, Tex. Radiation Physics Branch.
ELECTROMAGNETIC RADIATION EFFECTS ON THE EYE **c52**
John C. Mitchell *In* AGARD Radiation Hazards Aug. 1975 6 p refs (For availability see N76-11693 02-51)

The purpose is to analyze, collectively, the EMR research studies on ocular effects and provide an overview of the practical aspects of this problem today. The principal conclusions from this effort are: (1) The acute thermal insult from high intensity EMR fields is cataractogenic if intraocular temperatures reach 45-55 C. (2) The EMR exposure threshold is about 100-150 mW/sq cm applied for about 60-100 minutes. (3) There does not appear to be a cumulative effect from EMR exposures unless each single exposure is sufficient to produce some irreparable degree of injury to the eyes. Author

N76-11698 Rochester Univ., N.Y. Dept. of Radiation Biology and Biophysics.
ENDOCRINE AND CENTRAL NERVOUS SYSTEM EFFECTS OF MICROWAVE EXPOSURE **c52**
Sol M. Michaelson *In* AGARD Radiation Hazards Aug. 1975 8 p refs (For availability see N76-11693 02-51)

Functional alterations in the neuroendocrine system of both animals and humans exposed to microwaves were reported. Findings include changes in the secretions of the pituitary gland, adrenal cortex, thyroid gland, and the gonads. In most cases, the endocrine changes attributed to microwave exposure were not adequately documented. Findings of a large number of studies were used to overstate the conclusions, or derive assumptions incompatible with the cybernetic model of the function of the neuroendocrine system. Author

N76-11699 Washington Univ., Seattle. Bioelectromagnetics Research Lab.
MICROWAVE INDUCED ACOUSTIC EFFECTS IN MAMMALIAN AUDITORY SYSTEMS **c52**
Arthur W. Guy and Chung-Kwang Chou *In* AGARD Radiation Hazards Aug. 1975 17 p refs (For availability see N76-11693 02-51)

Pulsed microwave fields with incident energy densities of 20 to 40 micro Joule per sq cm per pulse will produce responses in the auditory system of man and animals similar to those produced by auditory stimuli. Recent studies indicate that the responses may be originated from high frequency vibrations induced in the head of the exposed subject by a transient thermal expansion of tissue due to the rapid absorption of the pulsed microwave energy. Author

N76-11700 Royal Marsden Hospital, Sutton (England). Physics Div.
BIOLOGICAL EFFECTS OF ULTRASOUND **c52**
C. R. Hill *In* AGARD Radiation Hazards Aug. 1975 4 p refs (For availability see N76-11693 02-51)

Ultrasound comprises mechanical vibrations occurring in the frequency range above 20 kHz and extending in practice to above 10 Hz; correspondingly, there is a very wide range of practical applications, each with different possibilities for exposure of human beings to ultrasonic energy. Three main areas that are necessary to understand the possible hazards from ultrasound use are discussed: (1) the actual physical exposures encountered by humans in various activities; (2) the nature of the biophysical interactions of ultrasound with human tissues; and (3) the evidence for and against significant changes being produced in living systems by the action of ultrasound. Author

N76-11701 Washington Univ., Seattle. Bioelectromagnetics Research Lab.
ENGINEERING CONSIDERATIONS AND MEASUREMENTS **c52**
Arthur W. Guy *In* AGARD Radiation Hazards Aug. 1975 36 p refs (For availability see N76-11693 02-51)

Quantitation of the biological effects in subjects exposed to electromagnetic fields requires that both the fields in the environment and within the exposed tissues be measured. Fields in the environment can be measured by means of standard off-the-shelf field survey meter sensors consisting of small dipoles with diode or thermocouple-type transducers for converting microwaves or RF energy to proportional electrical signals. Fields and associated absorbed power density in the tissues can be measured by means of thermocouples, thermistors, fiber optic liquid crystal sensors, and thermography. The quantitation of fields associated with exposure of test subjects can be significantly simplified by a judicious choice of exposure techniques. Author

N76-11702 Air Force Systems Command, Brooks AFB, Tex. School of Aerospace Medicine.
ELECTROMAGNETIC INTERFERENCE OF CARDIAC PACEMAKERS **c54**
John C. Mitchell *In* AGARD Radiation Hazards Aug. 1975 10 p refs (For availability see N76-11693 02-51)

The effect of electromagnetic radiation (EMR) on cardiac pacemakers is a unique bioeffects problem. Current test procedures, including methods to simulate pacemaker implant conditions and the use of fiber optics instrumentation techniques for cardiac simulation and pacemaker interference evaluation, are presented. Test results and their clinical significance are discussed for different types of EMR emissions including microwave ovens, electrical appliances, gasoline engine ignition, radar, and intense electromagnetic pulse generators. Threshold values for pacemaker electromagnetic interference (EMI) range from 10 V/m for the more sensitive devices to greater than 300 V/m for the less susceptible devices. Such EMI threshold values are further modified by the frequency and pulse width of the incident EMR signal. Maximum interference coupling appears to occur at frequencies between 100 and 500 MHz and the EMI threshold is inversely proportional to pulse width over the range from one microsecond to several milliseconds. The ultimate biological effect is dependent on the characteristics of the EMR source, the proximity of the pacemaker user to the source, the attenuation afforded by body shielding and orientation, and the state-of-health

of the pacemaker user. The test results presented provide considerable evidence that many manufacturers have recognized EMI as a potential bioeffects problem and have taken the necessary corrective actions to build devices with good electromagnetic compatibility. Author

N76-11703 Washington Univ., Seattle. Dept. of Rehabilitation Medicine.
ON EMP SAFETY HAZARDS **c31**
Arthur W. Guy *In* AGARD Radiation Hazards Aug. 1975 7 p refs (For availability see N76-11693 02-51)

The only two quantitative criteria presently available for setting of electromagnetic pulse (EMP) safety standards are: (1) the ANSI C95.1 Safety Standard based on limiting thermal insult at microwave frequencies, and (2) the thresholds for the stimulation of excitable membranes by electric current. The first is not realistic for application to the EMP since the induced currents and energy deposition in exposed tissue is not based on an applied field amplitude and duration relationship, but is related only to the rise and fall time of the applied field pulse. The induced currents in the tissues of man exposed to impulsive electromagnetic fields do not appear to be sufficient for stimulating action potentials. Author

N76-11704 Rochester Univ., N.Y. School of Medicine and Dentistry.
PROTECTION GUIDES AND STANDARDS FOR MICROWAVE EXPOSURE **c31**
Sol M. Michaelson *In* AGARD Radiation Hazards Aug. 1975 6 p refs (For availability see N76-11693 02-51)

The development of adequate and operable standards requires comprehensive evaluation of information obtained from animal experiments and surveys of individuals exposed occupationally. The criteria to be used in evaluating experimental results of microwave exposure and the interacting variables in such assessment requires the exercise of informed judgement. Since there are variations in the criteria used in many countries, these have to be understood and evaluated. Guides and exposure levels in force today appear to be entirely safe. So far, there is no documented evidence of injury to military or industrial personnel or the general public from the operation and maintenance of radars and other RF and microwave emitting sources within the 10 mW/sq cm limit of exposure. There is no evidence of hazard to man from RF and microwaves under normal conditions of operation and exposure. Nevertheless, concern has been aroused about the safety of personnel in intense RF fields close to transmitting antennas operating in the frequency bands below 30 MHz. Such environments are in general of a near-field type which precludes the measurement of power flux. Since hazard evaluation in this frequency range is a function of measurement in the near-field, attention should be paid to the problems inherent in such measurement. Author

N76-11705*# Pennsylvania Univ., Philadelphia. Plant Centrifuge Lab.
CIRCADIAN RHYTHM OF LEAF MOVEMENT IN CAPSICUM ANNUUM OBSERVED DURING CENTRIFUGATION
D. K. Chapman, A. H. Brown, and A. O. Dahl 7 Nov. 1975 24 p refs
(Grants NGR-39-010-104; NGR-39-010-149; NGR-39-030-010)
(NASA-CR-145614; CIRCAD-1) Avail: NTIS HC $3.50 CSCL 06C

Plant circadian rhythms of leaf movement in seedlings of the pepper plant (Capsicum annuum L., var. Yolo Wonder) were observed at different g-levels by means of a centrifuge. Except for the chronically imposed g-force all environmental conditions to which the plants were exposed were held constant. The circadian period, rate of change of amplitude of successive oscillations, symmetry of the cycles, and phase of the rhythm all were found not to be significantly correlated with the magnitude of the sustained g-force. Author

N76-11647 World Meteorological Organization, Geneva (Switzerland).
HEAT STRESS IN INDIGENOUS CATTLE
V. A. Finch *In its* Agroclimatol. of the Highlands of Eastern Africa 1974 p 48-55 refs (For availability see N76-11640 02-47)
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52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-11706 RAND Corp., Santa Monica, Calif.
FUTURE SPACE EXPLORATION: AN EQUAL OPPORTUNITY EMPLOYER?
Glenda G. Callanen Aug. 1975 10 p refs
(P-5492) Avail: Issuing Activity

Although the traditional psychological impediments are diminishing, they have produced some scientific reasons why the U.S. has had no female astronauts. Women's two major obstacles have been the lack of skills required for astronaut selection and a lack of data on the female's tolerances for space flight stresses. The latter problem has been partially reduced by the 1973 tests conducted at the Ames Research Center in California. Based on the test results of 12 Air Force nurses, which indicated that females apparently tolerate space flight stresses as well as males, NASA announced that women will not be excluded from the crews of the planned space shuttle flights. Author

N76-11707*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 145
Sep. 1975 96 p refs
(NASA-SP-7011(145)) Avail: NTIS HC $5.00 CSCL 06E

This bibliography lists 301 reports, articles, and other documents introduced into the NASA scientific and technical information system in August 1975. Author

N76-11708*# Transemantics, Inc., Washington, D.C.
REDUCTION OF THE BACTERIAL CONTAMINATION BY THE USE OF LAMINAR FLOW IN THE CONSTRUCTION OF CARDIAC VALVES
A. Juffe, E. J. Perea, J. L. Castillo-Olivares, and D. Figuear Washington NASA Nov. 1975 9 p refs Transl. into ENGLISH from Prensa Med. Arg. (Buenos Aires), v. 62, no. 5, May 1975 p 109-111
(Contract NASw-2792)
(NASA-TT-F-16643) Avail: NTIS HC $3.50 CSCL 06M

The effect of laminar flow on reducing microbial contamination during the construction of valves from fascia lata was studied. It was found that there was a significant reduction (P less than 0.005) in the bacterial count in the group of valves constructed under conditions of laminar flow, as compared with the test group constructed in an adjacent operating room, not using conditions of laminar flow. Author

N76-11709*# Scientific Translation Service, Santa Barbara, Calif.
VISION FROM A MOVING CAR (NO.1)
H. OHara Washington NASA Oct. 1975 26 p Transl. into ENGLISH from Nippon Ganka Gakkei Zasshi (Tokyo), v. 54, no. 9, 28 Sep. 1950 p 320-332
(Contract NASw-2791)
(NASA-TT-F-16638) Avail: NTIS HC $4.00 CSCL 05E

The effects of motion on human recognitive abilities were studied by evaluating visual acuity while subjects were in moving trains, automobiles, or locomotives. Measurements on the distance of recognition while approaching a marker or while moving away from it showed a decreasing positive value as the rate of speed increased. G.G.

N76-11710*# Kanner (Leo) Associates, Redwood City, Calif.
SOME HEMODYNAMIC INDICES AT HIGH ALTITUDE AT REST AND AFTER INTENSE PHYSICAL EXERCISE
V. G. Mashkovskiy Washington NASA Oct. 1975 13 p refs Transl. into ENGLISH from Kardiologiya (Moscow), v. 15, no. 6, Jun. 1975 p 61-67
(Contract NASw-2790)
(NASA-TT-F-16639) Avail: NTIS HC $3.50 CSCL 06S

For 5 years, 364 normal males, aged 19-25, were studied at the altitude of 3800-4200 m along with local inhabitants of the mountain region. Hemodynamic shifts and arterial blood oxygenation were studied with the base metabolism conditions preserved both at rest and after intensive physical exercises. The exercises were performed according to the step-test method (cardiological motion test, WHO 1967). The maximum physical workload caused a distinct intensification of the circulatory reactions, especially in those living for considerable periods of time at high altitude. Most of these subjects showed no ill effects from the exercise. Hence, they must have a considerable reserve of functional capacities of their cardiovascular system, and be capable of hard muscle work at high altitudes. There was a noticeable difference in test results of persons who had been at high altitude for different time periods. Author

N76-11711*# Kanner (Leo) Associates, Redwood City, Calif.
AN EVALUATION OF RESULTS OF ERGOMETRIC STUDIES
V. P. Pomerantsev, V. L. Khomenko, A. G. Ivashchuk, and A. I. Mikheyev Washington NASA Oct. 1975 10 p refs Transl. into ENGLISH from Kardiologiya (USSR), v. 15, no. 6, Jun. 1975 p 57-61
(Contract NASw-2790)
(NASA-TT-F-16641) Avail: NTIS HC $3.50 CSCL 16P

An evaluation of some standardized and relative indices of ergometry is presented: heart rate and oxygen consumption as percentage of individual values, indices of chromo-, inotropic, aerobic and coronary reserves. The investigation is based on the study of 113 normal individuals, 363 hypertonic patients, and 100 patients with ischaemic heart disease. The use of the relative values of the heart rate and oxygen consumption shows that the role of individual factors (sex, age, body weight) was neglible. The determination of the relative augmentation of these indices, as well as of the arterial pressure, permits making the state of functional reserves of the cardiopulmonary system more precise and can be used for the diagnosis and evaluation of therapeutic results. Author

N76-11712*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Biotechnology and Space Sciences Dept.
EVALUATION OF EARLY RECOGNITION OF VIRAL INFECTIONS IN MAN Final Report
A. A. Kelton and M. B. Lawton Oct. 1975 250 p refs
(Contract NAS9-13740)
(NASA-CR-144559) Avail: NTIS HC $8.00 CSCL 06E

The potential of Lymphocyte Specific Gravity Distribution (LSGD) as a non-specific procedure for early diagnosis of viral disease in astronauts is considered. Results of experiments and a literature search show that several virus diseases result in distinctive changes in the specific gravity distribution of peripheral blood lymphocytes as a result of disease process and associated immune response. A tentative model is proposed which relates the shape of LSGD to the identity of subpopulations of peripheral lymphocytes in a preclinical viral disease situation. G.G.

N76-11713*# Missouri Univ., Kansas City.
APPLICATION OF CABIN ATMOSPHERE MONITORS TO RAPID SCREENING OF BREATH SAMPLES FOR THE EARLY DETECTION OF DISEASE STATES Final Report, 1 Oct. 1974 - 30 Sep. 1975
Jimmie L. Valentine and Paul J. Bryant 30 Sep. 1975 26 p refs
(Contract NAS9-14369)
(NASA-CR-144548) Avail: NTIS HC $4.00 CSCL 06B

Analysis of human breath is a nonintrusive method to monitor both endogenous and exogenous chemicals found in the body. Several technologies were investigated and developed which are applicable to monitoring some organic molecules important in both physiological and pathological states. Two methods were developed for enriching the organic molecules exhaled in the breath of humans. One device is based on a respiratory face mask fitted with a polyethylene foam wafer; while the other device is a cryogenic trap utilizing an organic solvent. Using laboratory workers as controls, two organic molecules which occurred in the enriched breath of all subjects were tentatively identified as lactic acid and contisol. Both of these substances occurred in breath in sufficient amounts that the conventional method of gas-liquid chromatography was adequate for detection and quantification. To detect and quantitate trace amounts of chemicals in breath, another type of technology was developed in which analysis was conducted using high pressure liquid chromatography and mass spectrometry. Author

N76-11714*# Lecler (Michel), Inc., Harvey, La.
REPORT ON COMPUTATION OF REPETITIVE HYPERBARIC-HYPOBARIC DECOMPRESSION TABLES
Peter O. Edel 15 May 1975 34 p refs
(Contract NAS9-14352)
(NASA-CR-144560) Avail: NTIS HC $4.00 CSCL 06S

The tables were constructed specifically for NASA's simulated weightlessness training program; they provide for 8 depth ranges covering depths from 7 to 47 FSW, with exposure times of 15 to 360 minutes. These tables were based up on an 8 compartment model using tissue half-time values of 5 to 360 minutes and Workmanline M-values for control of the decompression obligation resulting from hyperbaric exposures. Supersaturation ratios of 1.55:1 to 2:1 were used for control of ascents to altitude following such repetitive dives. Adequacy of the method and the resultant tables were determined in light of past experience with decompression involving hyperbaric-hypobaric interfaces in human exposures. Using these criteria, the method showed conformity with empirically determined values. In areas where a discrepancy existed, the tables would err in the direction of safety. Author

N76-11715# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
A REVIEW OF THE TOXICOLOGY OF HALOGENATED FIRE EXTINGUISHING AGENTS Final Report
E. W. VonStee Nov. 1974 89 p refs
(AF Proj. 6302)
(AD-A011538; AMRL-TR-74-143) Avail: NTIS CSCL 06/20

Bromotrifluoromethane (Halon 1301), bromochlorodifluoromethane (Halon 1211), and chlorobromomethane (Halon 1011) were evaluated for toxicity and toxic hazards. The most important toxicological effects of these compounds are on the central nervous and cardiovascular systems. The neurological effects are manifested as alterations of perception and a reduction in reaction time and the ability to concentrate on complex intellectual tasks. The cardiovascular effects are manifested as changes in cardiovascular dynamics and the electrical activity of the heart. Clinically important central nervous system effects generally appear at lower levels of exposure than clinically important cardiovascular effects. Behavioral changes and performance decrements during exposure would undoubtedly have some effect on the interaction of the subject with his environment, and such consequences of exposure could be life-threatening. GRA

N76-11716# Texas Univ., Austin. Bio-Medical Engineering Research Lab.
SLEEP-WAKEFULNESS DETERMINATIONS FROM HEART RATE DATA Interim Report, 1 May 1974 - 30 Apr. 1975
Mike Lisenby, R. C. Richardson, and A. J. Welch 15 Jun. 1975 185 p refs
(Contract DAMD17-74-C-4081)
(AD-A012275; TR-173) Avail: NTIS CSCL 06/16

In recent years a number of projects related to the automated classification of levels of alertness have been conducted in the Bio-Medical Engineering Program. All of these projects were designed with a common goal in mind: the development of a process by which rapid, inexpensive determinations of levels of alertness could be performed accurately using an easily derived physiologic parameter such as beat-by-beat heart rate. By combining procedures and results of these previous studies a conglomerate algorithm can be developed which has all the necessary capabilities. One of the primary goals was achieved: the reduction of cost, volume, and complexity in automated classification of levels of alertness. It was felt that improvements can be made which will provide substantial progress toward fulfilling the remainder of the goals. GRA

N76-11717# Army Aeromedical Research Lab., Fort Rucker, Ala.
EFFECTS OF OXYGEN AND REDUCED GLUTATHIONE ON

THE OXYGEN CONSUMPTION OF MOUSE LIVER Final Report
Dennis A. Baeyens and Mary J. Meier May 1975 16 p refs
(AD-A012172; USAARL-75-20) Avail: NTIS CSCL 06/19

The effects of hyperbaric oxygen tensions on the oxygen consumption of mouse liver homogenates was investigated. Hyperbaric oxygen rapidly inhibits the oxidative metabolism of the mammalian liver. Mouse liver homogenate exposed to a PO2 of 3837.8 mm Hg for 30 minutes showed a 50.6% reduction in oxygen consumption compared to controls exposed to nitrogen at ambient pressure. The effect of reduced glutathione (GSH) as a protective agent against hyperbaric oxygen toxicity was also examined. Liver homogenates pretreated with GSH and exposed to high oxygen tensions demonstrated greater activity than untreated controls. It is concluded that: (1) GSH protects important enzymes of oxidative metabolism by keeping them in a reduced and viable state, and (2) GSH can stimulate oxygen consumption by increasing succinate formation through a GSH-succinate shunt. GRA

N76-11718# Human Engineering Labs., Aberdeen Proving Ground, Md.
A SIMULATION OF THE HUMAN SHOULDER Final Technical Memo
Richard R. Kramer May 1975 56 p refs
(AD-A012174; HEL-TM-15-75) Avail: NTIS CSCL 05/5

A method is presented for estimating the recoil force at the interface between the firer's shoulder and his weapon. The method involves simultaneous second order differential equations, whose coefficients have been determined by empirical fits. An example is given, which shows how the initial pitch-up and the recoil forces of a rocket launcher can be estimated. GRA

N76-11719# New Mexico Univ., Albuquerque. Dept. of Anatomy
STUDIES OF ORIENTATIONAL AND POSTURAL MECHANISMS IN A MODEL NEURAL SYSTEM Final Report, 1 Feb. 1973 - 1 Feb. 1975
Leo S. Demski and Diana H. Bauer Feb. 1975 53 p refs
(Grant AF-AFOSR-2491-73; AF Proj. 9777)
(AD-A012027; AFOSR-75-0829TR) Avail: NTIS CSCL 06/16

Utilizing eye movements as a measure of vestibular activity, regions of the brain involved in their control and in possible mediation of postural and orientational responses have been studied through electrical stimulation of the brain in anesthetized animals. A mapping of the brain has been accomplished. Experiments performed on chronically implanted animals indicate that stimulation of the brain in areas associated with eye movements in the anesthetized subject in most cases produces a postural change which could be predicted from the eye movements of the manually positioned animal. Therefore, the areas of the brain related to movements identified in the earlier studies are probably also involved in more complex postural and orientational responses. GRA

N76-11720# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
ON THE PURPOSE OF LOW-LEVEL VISION
David Marr Dec. 1974 31 p refs
(Contract N00014-70-A-0362-0005)
(AD-A012392; AI-M-324) Avail: NTIS CSCL 06/4

The article advances the thesis that the purpose of low-level vision is to encode symbolically all of the useful information contained in an intensity array, using a vocabulary of very low-level symbols. Subsequent processes should have access only to this symbolic description. The reason is one of computational expediency. It allows the low-level processes to run almost autonomously; and it greatly simplifies the application of criteria to an image, whose representation in terms of conditions on the initial intensities, or on simple measurements made from them, is very cumbersome. GRA

N76-11721# Environmental Health Lab., McClellan AFB, Calif.
HEALTH HAZARD POTENTIAL OF HYPOL (TRADEMARK) POLYURETHANE PREPOLYMERS Final Report
Marlin L. Sweigart and Philip Diamond May 1975 52 p refs
(AD-A011997; EHL-M-75M-9) Avail: NTIS CSCL 06/10

This report presents the results of an evaluation of the potential hazards associated with the use of various formulations of foamable hydrophilic polyisocyanates containing one to two weight percent free toluene diisocyanate (TDI) in Air Force Pacer Foam operations. TDI concentrations and generation rates are presented as well as recommended controls for the use of these prepolymers in foaming operations. Permissible dosage and analysis procedures are also discussed. GRA

N76-11310 Letterman Army Inst. of Research, San Francisco, Calif. Non-Ionizing Radiation Div.
OCULAR EFFECTS OF LASER RADIATION: CORNEA AND ANTERIOR CHAMBER
Edwin S. Beatrice and Bruce E. Stuck *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 5 p refs (For availability see N76-11306 02-31)

N76-11311 Letterman Army Inst. of Research, San Francisco, Calif. Non-Iodizing Radiation Div.
OCULAR EFFECTS OF RADIATION: RETINA
Edwin S. Beatrice *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 4 p refs (For availability see N76-11306 02-31)

N76-11312 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
DETERMINATION OF SAFE EXPOSURE LEVELS: ENERGY CORRELATES OF OCULAR DAMAGE
R. G. Borland *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 6 p refs (For availability see N76-11306 02-31)

N76-11315 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
OPTHALMOLOGICAL EXAMINATION OF LASER WORKERS AND INVESTIGATION OF LASER ACCIDENTS
D. H. Brennan *In* AGARD Laser Hazards and Safety in the Mil. Environ. Aug. 1975 11 p ref (For availability see N76-11306 02-31)

N76-11694 Rochester Univ., N.Y. School of Medicine and Dentistry.
PATHOPHYSIOLOGIC ASPECTS OF EXPOSURE TO MICROWAVE
Sol M. Michaelson *In* AGARD Radiation Hazards Aug. 1975 7 p refs (For availability see N76-11693 02-51)

N76-11696 Washington Univ., Seattle. Bioelectromagnetics Research Lab.
BIOPHYSICS - ENERGY ABSORPTION AND DISTRIBUTION
Arthur W. Guy *In* AGARD Radiation Hazards Aug. 1975 14 p refs (For availability see N76-11693 02-51)

N76-11697 Air Force Systems Command, Brooks AFB, Tex. Radiation Physics Branch.
ELECTROMAGNETIC RADIATION EFFECTS ON THE EYE
John C. Mitchell *In* AGARD Radiation Hazards Aug. 1975 6 p refs (For availability see N76-11693 02-51)

N76-11698 Rochester Univ., N.Y. Dept. of Radiation Biology and Biophysics.
ENDOCRINE AND CENTRAL NERVOUS SYSTEM EFFECTS OF MICROWAVE EXPOSURE
Sol M. Michaelson *In* AGARD Radiation Hazards Aug. 1975 8 p refs (For availability see N76-11693 02-51)

N76-11699 Washington Univ., Seattle. Bioelectromagnetics Research Lab.
MICROWAVE INDUCED ACOUSTIC EFFECTS IN MAMMALIAN AUDITORY SYSTEMS
Arthur W. Guy and Chung-Kwang Chou *In* AGARD Radiation Hazards Aug. 1975 17 p refs (For availability see N76-11693 02-51)

N76-11700 Royal Marsden Hospital, Sutton (England). Physics Div.
BIOLOGICAL EFFECTS OF ULTRASOUND
C. R. Hill *In* AGARD Radiation Hazards Aug. 1975 4 p refs (For availability see N76-11693 02-51)

N76-11701 Washington Univ., Seattle. Bioelectromagnetics Research Lab.
ENGINEERING CONSIDERATIONS AND MEASUREMENTS
Arthur W. Guy *In* AGARD Radiation Hazards Aug. 1975 36 p refs (For availability see N76-11693 02-51)

N76-11924 Joint Publications Research Service, Arlington, Va.
BIOMEDICAL RESEARCH
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 81-93 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 13 p (For availability see N76-11919 02-88)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-11722*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
THE ANALYSIS OF THE PILOT'S COGNITIVE AND DECISION PROCESSES Progress Report, 1 Mar. - 31 Aug. 1975
R. E. Curry 31 Aug. 1975 85 p refs
(Grant NGR-22-009-733)
(NASA-CR-145739) Avail: NTIS HC $5.00 CSCL 05E

Articles are presented on pilot performance in zero-visibility precision approach, failure detection by pilots during automatic landing, experiments in pilot decision-making during simulated low visibility approaches, a multinomial maximum likelihood program, and a random search algorithm for laboratory computers. Other topics discussed include detection of system failures in multi-axis tasks and changes in pilot workload during an instrument landing. M.J.S.

N76-11723# Army Personnel Research Committee, London (England).
THE EFFECT OF A FILTERED CONTROL ON OPERATORS' HAND TREMOR
M. Waygood Apr. 1974 15 p refs
(APRC-72/cs-7; BR47799) Avail: NTIS HC $3.50

The twelve operators compensated for errors they produced while holding a spot central in a stationary square target. Filtering their control movements obtained from strain gauges increased their proficiency compared with a condition in which the control movements were presented at a gain of 189. It is argued that filtering of the operator's control demands may improve his performance, when the target is stationary. Author (ESA)

N76-11724# Michigan Univ., Ann Arbor. Human Performance Center.
THE EFFECT OF TIME SHARING ON THE PERFORMANCE OF INFORMATION PROCESSING TASKS: A FEEDBACK CONTROL ANALYSIS
Christopher Dow Wickens Aug. 1974 167 p refs
(Contract F44620-72-C-0019)
(AD-A012023; TR-51; Rept-010588-21-T; AFOSR-75-0906TR) Avail: NTIS CSCL 05/10

The limited nature of man's attentional processes is a fundamental principle that underlies any general theory of human performance or human information processing. However, psychologists have been unable to settle upon a precise definition of the term attention. One approach that can be taken toward clarifying ambiguity in the meaning of attention is to study man's behavior in a time sharing paradigm, one in which attention must be shared between the performance of two or more tasks. The purpose of the current research was to examine these time-sharing effects in a manual tracking paradigm, employing the fine-grained analysis provided by the techniques of feedback control theory. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-11725# Aeronautical Research Labs., Melbourne (Australia).
DYNAMIC TESTS OF A YIELDING SEAT AND SEAT BELT SYSTEM FOR CRASH PROTECTION
S. R. Sarrailhe and N. D. Hearn Mar. 1975 43 p refs
(ARL/Struc-358) Avail: NTIS HC $4.00

Dynamic tests were carried out on standard and yielding seat belt restraint systems to evaluate and compare their performance. The seat belts were of the lap sash type with the lap straps attached to the seat. The yielding system had energy absorbers in the sash strap and seat anchorage. Test sled accelerations ranged from 120 to 240 m/sec/sec with the standard belt and to 300 m/sec/sec with the yielding system. Peak restraint loads increased progressively with increase in acceleration in the case of the standard system, but the yielding system allowed an increase in the acceleration of approximately 85% without an increase in peak load. At a sled acceleration of 240 m/sec/sec the load in the yielding system was 70% of that in the standard system. The work is applicable to restraints in both aircraft and motor vehicles. Author

N76-11726*# Fairchild Republic Co., Farmingdale, N.Y.
SPACE SHUTTLE GALLEY WATER SYSTEM TEST PROGRAM Final Report
Oct. 1975 26 p
(Contract NAS9-14719)
(NASA-CR-144531; RD008V3201) Avail: NTIS HC $4.00 CSCL 06K

A water system for food rehydration was tested to determine the requirements for a space shuttle gallery flight system. A new food package concept had been previously developed in which water was introduced into the sealed package by means of a needle and septum. The needle configuration was developed and the flow characteristics measured. The interface between the food package and the water system, oven, and food tray was determined. Author

N76-11727*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SKYLAB EXPERIMENT M487 HABITABILITY/CREW QUARTERS
Caldwell C. Johnson Oct. 1975 61 p refs
(NASA-TM-X-58163; JSC-09677) Avail: NTIS HC $4.50 CSCL 06K

Results of Skylab experiment M487 (habitability/crew quarters), which was designed to evaluate the habitability features of Skylab, were presented. General observations and conclusions drawn from the data obtained are presented in detail. The objectives of the experiment, the manner in which data was acquired, and the instruments used to support the experiments are described. Illustrations and photographs of the living and work areas of Skylab and some of the habitability features are provided. Samples of the subjective evaluation questionnaires used by the crewmen are included. Habitability-related documents, crewmen biographies, functional characteristics and photographs of the instruments used, and details of Skylab compartment sizes and color schemes are included as appendixes. Author

N76-11728# Dow Chemical Co., Golden, Colo. Radiation Monitoring Group.
QUANTITATIVE RESPIRATOR MAN-TESTING AND ANTHROPOMETRIC SURVEY
J. D. Leigh 22 May 1975 12 p ref
(Contract AT(29-1)-1106)
(RFP-2358; TID-4500-R62) Avail: NTIS HC $4.00

A recent anthropometric survey and test procedures are reported for the respiratory protection program to safeguard the health of personnel. Respiratory protection procedures involve the selection of face masks worn by plant personnel. The fitting, handling, and use of face masks through explicit instructions can assure optimum protection. Comparisons are made with the test panel selection parameters established by the Los Alamos

Scientific Laboratory in Los Alamos, New Mexico, and recommendations by Webb Associates of Yellow Springs, Ohio.
Author (NSA)

N76-11729# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF A TRACKING TASK ON SPEECH INTELLIGIBILITY IN NOISE Ph.D. Thesis - Southampton Univ., Engl., 1974
Mary E. Johnston Mar. 1975 48 p refs
(RAE-TR-75014; BR64915) Avail: NTIS HC $4.00

An investigation is described which was carried out to study the effect of noise, and performance of a tracking task on speech intelligibility. The results indicate that for some subjects there is a significant detrimental effect of tracking on speech intelligibility, and that this effect may be offset by improving the signal/noise ratios of communication. These results suggest that it is inaccurate to use data based on classical single-stress intelligibility tests in the design and assessment of communication systems to be used in multi-activity, real life situations. Author (ESA)

N76-11730# General Electric Co., Lynn, Mass. Direct Energy Conversion Programs
RESEARCH ON REVERSE OSMOSIS MEMBRANES FOR PURIFICATION OF WASH WATER AT STERILIZATION TEMPERATURE (165 DEGREES F) Research Report, Mar. 1971 - Sep. 1974
M. E. Nolan and A. B. LaConti Jun. 1975 58 p refs
(Contract DI-14-30-2752)
(PB-242521/3; W75-08575; Int-OSW-RDPR-75-1003; RR-2) Avail: NTIS HC $4.50 CSCL 07A

The goal was to develop viable reverse osmosis (RO) modules and systems of tubular design of approximately 80 gpd capacity to recover wash water at sterilization temperatures. An 80 gpd RO system was fabricated for recovering wash water at sterilization temperatures. The performance characteristics of ancillary components including particulate filters, gauges, meters, RO pump, accumulator carbon polishing column were verified by integrating the components into a suitable subsystem containing the RO module and life testing with wash water. The twenty tube module was used to define the total system and identify/correct some of the life limiting problems, and was tested under simulated mission conditions with wash water. GRA

N76-11731# Navy Clothing and Textile Research Unit, Natick, Mass.
VISOR SYSTEM MATERIALS FOR ALUMINIZED FIREMEN'S HOODS. REPORT NO. 1: PROBLEM IDENTIFICATION
Norman F. Audet May 1975 28 p refs
(AD-A011420; TR-111) Avail: NTIS CSCL 06/7

The study determined the durability of the gold-coated facepiece component of the crash-crew firefighters' visor system, because field observations indicated that the gold coating wore off readily. The study examined methods employed by fire station personnel in caring for the facepiece and in replacing it; and the effect of various contaminants and abrasive materials on the quality of the gold coating and its subsequent heat resistance. GRA

N76-11732# Synsis, Inc., Los Angeles, Calif.
PROTOTYPE COLD WEATHER HEADWEAR Final Report, Oct. 1973 - Oct. 1974
David Mangelsdorf, Marvin Goldberg, and Heidi Santschi Oct. 1974 73 p refs
(Contract DAAK03-74-C-0030; DA Proj. 1T7-62713-DJ-40)
(AD-A012314; USA-NLABS-TR-75-42-CE; CE/MEL-137) Avail: NTIS CSCL 06/17

Prototypes of an improved cold weather headgear ensemble have been developed which should provide protection from cold, wind, blowing snow, and frostbite in environments to -65F and 35 miles per hour wind velocities. The ensemble provides physical compatibility with military clothing and equipment and does not occlude the field of vision. The design covers the face, head and neck and is provided with features that permit achieving varying degrees of protection in response to varying severity of the environmental threat. The ensemble and its elements are composed largely of a helenca/urethane foam/cotton jersey laminate which provides excellent insulating properties, sound transparency, and permeability. GRA

N76-11316 Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md. Laser Microwave Div.
LASER PROTECTIVE DEVICES
David H. Sliney *In* AGARD Laser Hazards and Safety in the Mil. Environ. 1975 11 p refs (For availability see N76-11306 02-31)

N76-11702 Air Force Systems Command, Brooks AFB, Tex. School of Aerospace Medicine.
ELECTROMAGNETIC INTERFERENCE OF CARDIAC PACEMAKERS
John C. Mitchell *In* AGARD Radiation Hazards Aug. 1975 10 p refs (For availability see N76-11693 02-51)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N76-11733*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL METHOD FOR DETERMINING THE STABILITY OF LINEAR RETARDED SYSTEMS WITH TWO DELAYS
L. Keith Barker and J. L. Whitesides (Joint Inst. for Acoustics and Flight Sci., Hampton, Va.) Washington Nov. 1975 35 p refs
(NASA-TR-R-446; L-10303) Avail: NTIS HC $4.00 CSCL 12A

The stability is considered of the solution differential-difference equations of the retarded type with constant coefficients and two constant time delays. A method that makes use of analytical expressions to determine stability boundaries, and the stability of the system, is derived. The method was applied to a system represented by a second-order differential equation with constant coefficients and time dalays in the velocity and displacement terms. The results obtained is in agreement with those obtained by other investigators. Author

N76-11734*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A TRANSFORMATION METHOD FOR CONSTRAINED-FUNCTION MINIMIZATION
Stephen K. Park Washington Nov. 1975 37 p refs
(NASA-TN-D-7983; L-10178) Avail: NTIS HC $4.00 CSCL 09B

A direct method for constrained-function minimization is discussed. The method involves the construction of an appropriate function mapping all of one finite dimensional space onto the region defined by the constraints. Functions which produce such a transformation are constructed for a variety of constraint regions including, for example, those arising from linear and quadratic inequalities and equalities. In addition, the computational performance of this method is studied in the situation where the Davidon-Fletcher-Powell algorithm is used to solve the resulting unconstrained problem. Good performance is demonstrated for 19 test problems by achieving rapid convergence to a solution from several widely separated starting points. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N76-11735*# Hughes Aircraft Co., Fullerton, Calif.
DESIGN OF A MODULAR DIGITAL COMPUTER SYSTEM, CDRL NO. D001, FINAL DESIGN PLAN Technical Report, 1 Jan. 1974 - 1 Sep. 1975
R. A. Easton 2 Sep. 1975 120 p
(Contract NAS8-27926)
(NASA-CR-144038; FR-75-11-568) Avail: NTIS HC $5.50 CSCL 09B

The engineering breadboard implementation for the CDRL no. D001 modular digital computer system developed during design of the logic system was documented. This effort followed the architecture study completed and documented previously, and was intended to verify the concepts of a fault tolerant, automatically reconfigurable, modular version of the computer system conceived during the architecture study. The system has a microprogrammed 32 bit word length, general register architecture and an instruction set consisting of a subset of the IBM System 360 instruction set plus additional fault tolerance firmware. The following areas were covered: breadboard packaging, central control element, central processing element, memory, input/output processor, and maintenance/status panel and electronics. Y.J.A.

N76-11736*# TRW Systems Group, Redondo Beach, Calif. Space Sciences Dept.
AMPS DATA MANAGEMENT REQUIREMENTS STUDY Final Report
30 Jun. 1975 156 p
(Contract NAS8-31208)
(NASA-CR-143995; TRW-26487-6008-RU-00) Avail: NTIS HC $6.25 CSCL 09B

A data simulation is presented for instruments and associated control and display functions required to perform controlled active experiments of the atmosphere. A comprehensive user's guide is given for the data requirements and software developed for the following experiments: (1) electromagnetic wave transmission; (2) passive observation of ambient plasmas; (3) ionospheric measurements with a subsatellite; (4) electron accelerator beam measurements; and (5) measuremnt of acoustic gravity waves in the sodium layer using lasers. A complete description of each experiment is given. Author

N76-11737*# TRW Systems Group, Redondo Beach, Calif. Space Sciences Dept.
AMPS DATA MANAGEMENT REQUIREMENTS STUDY, APPENDIX 1 Final Report
30 Jun. 1975 235 p
(Contract NAS8-31208)
(NASA-CR-143996; TRW-26487-6008-RU-00-App-1) HC $7.50 CSCL 09B

Flow charts and display formats for the simulation of five experiments are given. The experiments are: (1) electromagnetic wave transmission; (2) passive observations of ambient plasma; (3) ionospheric measurements with subsatellite; (4) electron accelerator beam measurements; and (5) measurement of acoustical gravity waves in the sodium layer using lasers. A detailed explanation of the simulation procedure, definition of variables, and an explanation of how the experimenter makes display choices is also presented. A functional description is included on each flow chart and the assumptions and definitions of terms and scope of the flow charts and displays are presented. Author

N76-11738# Commission of the European Communities, Ispra (Italy). Joint Research Center.
CAMAC: A MODULAR INSTRUMENTATION SYSTEM FOR DATA HANDLING. SPECIFICATION OF AMPLITUDE ANALOGUE SIGNALS WITHIN A 50 OMEGA SYSTEM
1974 15 p
(EUR-5100-Rev-1) Avail: ERDA Depository Libraries HC $4.00

The EURATOM Report EUR 4100 defines the essential features of the CAMAC system of instrumentation. This system is primarily for online use with digital controllers or computers. Single-ended unipolar and bipolar amplitude analogue signals are specified which are recommended for CAMAC compatible units as used in a 50 ohm transmission system. It includes and extends the specifications of the previous version, EUR 5100 (1972). Author (NSA)

N76-11739# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
FAST CURVE AND SURFACE REPRESENTATION ON GRAPHICS DISPLAY DEVICES Ph.D. Thesis - Tech. Univ., Berlin [SCHNELLE KURVEN- UND FLAECHENDARSTELLUNG AUF GRAFISCHEN SICHTGERAETEN]
Wolfgang Strasser 1974 168 p refs In GERMAN
(TB-178) Avail: NTIS HC $6.75

The B-spline approximation was investigated as a possible method for representing curves and surfaces using a computer graphics display for interaction design. It is shown that this approximation is not only the most universal but also the easiest maintainable mathematical method. A new method for hatching curves in real time is indicated. Under consideration of new components, digital circuits are described for a display processor: vector generator, circle generator, matrix multiplier, divider, and curve- and surface-generator. ESA

N76-11740# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
AN ANALYSIS OF OPTIMAL RETRIEVAL SYSTEMS WITH UPDATES
Richard A. Flower Jun. 1975 74 p refs
(Contract DAAB07-74-C-0630; Grant NSF GK-37582)
(AD-A012308; TR-488) Avail: NTIS CSCL 09/2

The performance of computer-implemented systems for data storage, retrieval, and update was investigated. A memory that is bit-addressable by an algorithm or an automaton models a computer. A retrieval system is composed of a particular mapping of data bases onto memory representations and a particular algorithm or automaton. By accessing bits of memory, the algorithm can answer any questions about the d represented in memory and can update memory. Lower bounds are derived for the performance measures of storage efficiency, retrieval efficiency, and update efficiency. The minima are simultaneously attainable by a retrieval system for some data structures of interest. Trading relations between the measures exist for other data structures. Author

N76-11741# Maryland Univ., College Park. Computer Science Center.
PICTURE PROCESSING
Joan S. Weszka and Azriel Rosenfeld May 1975 51 p refs
(Contract N00014-75-C-0286)
(AD-A012402; TR-378) Avail: NTIS CSCL 09/2

This paper reviews the fundamentals of automatic picture processing and scene analysis. It discusses computer-based methods of segmenting picutres into meaningful parts; determining properties of the parts and relationships among the parts; and using this information to construct descriptions of the pictures. The material is organized by principal areas of application, including document reading, high-energy physics, cytology, radiology, and remote sensing of the environment. GRA

N76-11742# Sperry Univac, St. Paul, Minn. Defense Systems Div.
FAULT TOLERANCE IN GALOIS TREES: AN ALGORITHM FOR DETECTION AND LOCATION OF STUCK-AT TYPE ERRORS IN TREES OF GALOIS LINEAR MODULES
J. M. Marver Jun. 1975 16 p
(Contract N00014-75-C-0675)
(AD-A012397; PX-11292) Avail: NTIS CSCL 09/2

An algorithm detects and locates stuck-at type errors from the outputs of four-bit Galois linear modules arranged in a tree formation. An example is given describing the procedure in detail. GRA

N76-11743# Naval Postgraduate School, Monterey, Calif.
A SIMULATION OF A COMPUTER GRAPHICS-AIDED AIRCRAFT HANDLING SYSTEM M.S. Thesis
Alan Keith Johnson and Kriston Philip Woolley Jun. 1975 152 p refs
(AD-A012418) Avail: NTIS CSCL 13/10

Previous studies and research have determined that the aircraft handling problem aboard our modern aircraft carriers is needlessly complicated by inadequate communication and information handling. This study develops an interactive computer graphics system which would improve information handling. The proposed system will not make the logical decisions of the handling problem, but rather will assist handling and maintenance personnel in the presentation and exchange of aircraft information. The study includes a discussion of previous efforts in this area, a basic description of interactive computer graphics and presently available hardware, a description of the entire proposed system to be implemented onboard the carrier, and a computer graphics program that realistically simulates the workings of the displays proposed in the above mentioned system. GRA

N76-11744# Naval Postgraduate School, Monterey, Calif.
A COMPUTER SOLUTION TO THE DAILY FLIGHT SCHEDULE PROBLEM M.S. Thesis
C. G. Honour Jun. 1975 74 p refs
(AD-A012415) Avail: NTIS CSCL 05/9

A computer procedure to solve interactively the daily flight scheduling problem for training squadrons is proposed. The scheduling problem for a prototype squadron, Fighter Squadron One Hundred Twenty-one, is mathematically analyzed using graph coloring techniques. A procedure similar to published class scheduling solutions which uses an assignment algorithm is formulated. A computer program is then developed to demonstrate the procedure. GRA

N76-11745# Hawaii Univ., Honolulu. Dept. of Information and Computer Science.
OPTIMAL CONTROL OF DEMAND PAGING SYSTEMS
Art Let 1975 8 p refs
(Grant DA-ARO(D)-31-124-71-G43)
(AD-A011800; ARO-8803.15-EL) Avail: NTIS CSCL 09/2

Demand-paging systems are characterized as stochastic control processes, and optimal page replacement decisions are determined by means of dynamic programming. This approach is distinguished from others by its use of page structure information, which may be either supplied a priori or else dynamically learned. The main result is an optimal realizable solution for a general class of replacement problems. The resulting algorithm subsumes others (including (A sub 0)) as special cases. GRA

N76-11746# Mitre Corp., Bedford, Mass.
THE DESIGN AND SPECIFICATION OF A SECURITY KERNEL FOR THE PDP-11/45
W. L. Schiller May 1975 119 p refs
(Contract F19628-75-C-0001; AF Proj. 572B)
(AD-A011712; MTR-2934; ESD-TR-75-69) Avail: NTIS CSCL 09/2

This paper presents the design of a kernel for certifiably secure computer systems being built on the Digital Equipment Corporation PDP-11/45. The design applies a general purpose mathematical model of secure computer systems to an off-the-shelf computer. An overview of the model is given. The paper includes a specification of the design that will be the basis for a rigorous proof of the correspondence between the model and the design. This design and implementation has demonstrated the technical feasibility of the security kernel approach for designing secure computer systems. GRA

N76-11747# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
EFFECTS OF NUCLEAR RADIATION ON MAGNETIC BUBBLE DOMAIN MATERIALS AND DEVICES Final Report, 1 May 1973 - 31 Dec. 1974
Ross A. Williams Jan. 1975 92 p refs
(Contract F19628-73-C-0250; AF Proj. 6096)
(AD-A011702; C73-554/501; AFCRL-TR-75-0037) Avail: NTIS CSCL 09/2

The effort concentrates on radiation-induced failure thresholds and associated mechanisms for magnetic bubble domain devices. However, experiments to investigate the effects of low-energy X rays on bubble domain materials are also described. In the low-energy X-ray studies, changes in hard bubble suppression properties, or ferromagnetic-resonance spectra, were looked for in either of two types of iron garnets exposed to more than 6,000,000 R. The primary effort concerned transient radiation-induced memory loss. A 30 ns pulse of approximately 1.5 MeV electrons was used. Failure probabilities as a function of dose per pulse were obtained for several devices. Transient radiation-induced burnout of domain sensors was also studied for both thin (300 A) and thick (4000 A) permalloy detectors. GRA

N76-11748# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
IMAGE ANALYSIS AND MODELING Quarterly Progress Report, 1 Nov. 1974 - 31 Jan. 1975
Paul A. Wintz and J. S. Huang May 1975 59 p refs
(Contract F30602-75-C-0150; ARPA Order 2893; AF Proj. 2893)
(AD-A011929; TR-EE75-3; RADC-TR-75-144) Avail: NTIS CSCL 09/2

The objective of this research is to achieve a better understanding of image structure and to use this knowledge to develop improved image models for use in image analysis and processing tasks such as information extraction, image enhancement and restoration, coding, etc. The ultimate objective of this research is to form a basis for the development of technology relative to military applications of machine extraction of information from aircraft and satellite imagery of the earth's surface. Work reported here includes: image segmentation and decomposition, edge detection, texture analysis, clustering, feature extraction, coding and restoration. GRA

N76-11749# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A NOTE ON THE COMPUTATION OF BINOCULAR DISPARITY IN A SYMBOLIC, LOW-LEVEL VISUAL PROCESSOR
David Marr Dec. 1974 21 p refs
(Contract N00014-70-A-0362-0005)
(AD-A012393; AI-M-327) Avail: NTIS CSCL 09/2

The goals of the computation that extracts disparity from pairs of pictures of a scene are defined, and the constraints imposed upon that computation by the three-dimensional structure of the world are shown to be inadequate. A precise expression of the goals of the computation is possible in a low-level symbolic visual processor: the constraints translate in this environment to pre-requisites on the binding of disparity values to low-level symbols. The outline of a method based on this is given. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

includes computer programs, routines, and algorithms.

N76-11750*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INVESTIGATING TECHNIQUES IN THE GENERATION OF SUPPORT SOFTWARE Final Report
A. J. Edwards and Z. Jelinski Oct. 1975 17 p Revised
(Contract NAS8-30907)
(NASA-CR-144034; MDC-G5886-Rev) Avail: NTIS HC $3.50 CSCL 09B

The performance of the Meta assembler processor software package previously provided for the Space Ultrareliable Modular Computer (SUMC) at the Marshall Space Flight Center (MSFC) was verified. A number of adjustments were made to the processor following the rehosting of the SUMC software development facility (S4) on a newly acquired IBM 360/65. The assembler was configured to provide cross assembly capability for various target computers. Y.J.A.

N76-11751*# Martin Marietta Corp., Denver, Colo.
SCHEDULING LANGUAGE AND ALGORITHM DEVELOPMENT STUDY. VOLUME 1, PHASE 2: DESIGN CONSIDERATIONS FOR A SCHEDULING AND RESOURCE ALLOCATION SYSTEM Final Report
R. A. Morrell, R. J. ODoherty, H. R. Ramsey, C. C. Reynolds, J. K. Willoughby, and R. D. Working Oct. 1975 122 p refs 3 Vol.
(Contract NAS9-13616)
(NASA-CR-144528; MCR-75-390-Vol-1) Avail: NTIS HC $5.50 CSCL 09B

Data and analyses related to a variety of algorithms for solving typical large-scale scheduling and resource allocation problems are presented. The capabilities and deficiencies of various alternative problem solving strategies are discussed from the viewpoint of computer system design. Author

N76-11752*# Martin Marietta Corp., Denver, Colo.
SCHEDULING LANGUAGE AND ALGORITHM DEVELOPMENT STUDY. VOLUME 2, PHASE 2: INTRODUCTION TO PLANS PROGRAMMING Final Report
D. R. Cochran, M. K. Ishikawa, R. E. Paulson, and H. R. Ramsey Oct. 1975 149 p 3 Vol.
(Contract NAS9-13616)
(NASA-CR-144529; MCR-75-390-Vol-2) Avail: NTIS HC $6.00 CSCL 09B

A user guide for the Programming Language for Allocation and Network Scheduling (PLANS) is presented. Information is included for the construction of PLANS programs. The basic philosophy of PLANS is discussed, and access and update reference techniques are described along with the use of tree structures. F.O.S.

N76-11753*# Martin Marietta Corp., Denver, Colo.
SCHEDULING LANGUAGE AND ALGORITHM DEVELOPMENT STUDY. VOLUME 3, PHASE 2: AS-BUILT SPECIFICATIONS FOR THE PROTOTYPE LANGUAGE AND MODULE LIBRARY Final Report
J. B. Armstrong, D. R. Cochran, M. K. Ishikawa, R. J. ODoherty, R. E. Paulson, H. R. Ramsey, C. C. Reynolds, J. K. Willoughby, and C. R. Winslow Oct. 1975 596 p refs 3 Vol.
(Contract NAS9-13616)
(NASA-CR-144530; MCR-75-390-Vol-3) Avail: NTIS HC $13.75 CSCL 09B

Detailed specifications of the prototype language and module library are presented. The user guide to the translator writing system is included. F.O.S.

N76-11754*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Inst. for Mathematical Studies in the Social Sciences.
TENEX SAIL
Robert Smith 10 Jan. 1975 40 p refs Prepared for JPL
(Contract JPL-953857)
(NASA-CR-145690; SU-TR-248) Avail: NTIS HC $4.00 CSCL 09B

SAIL, a high level ALGOL language for the PDP-10, is extended to operate under the TENEX time sharing system without executing DEC system calls. A large set of TENEX oriented runtime routines are added to allow complete access to TENEX. The emphasis is on compatibility of programs across time sharing systems and integrity of the language. Author

N76-11755# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A NOTE ON AN ALGORITHM FOR GENERATING BESSEL FUNCTIONS OF INTEGER AND HALF ORDER
G. A. Evans Feb. 1975 11 p refs
(MATHS-Res-53) Avail: NTIS HC $3.50

An approach is made to develop an algorithm for generating Bessel functions Jn(z) and spherical Bessel function jn(z) for a wide range of both n and z. The problem of the unstable recurrence relation for higher order functions is considered using this relation in reverse. The proposed algorithm calculates n so that the required accuracy can be obtained in a single sweep of the reverse iteration. ESA

N76-11756# Oxford Univ. (England). Dept. of Engineering Science.
FLOATING-POINT ARITHMETIC ROUTINES AND MACROS FOR AN INTEL 8080 MICROPROCESSOR
S. N. Cope 1975 30 p ref
(OUEL-1123/75) Avail: NTIS HC $4.00

Floating point arithmetic routines and associated macros for the manipulation of floating point numbers by an INTEL 8080 microprocessor are described. Floating point arithmetic is needed for digital control system programs with particular application, at present, to a self tuning regulator. In the routines described, attention is paid to the speed of operation, in particular to reducing the length of multiply and divide loops, and to providing adequate over and underflow handling. The routines are accurate to the precision allowed by the double word size of some of the microprocessor instructions. The macros and routines were tested on a simulator of an INTEL 8080 microprocessor and successfully performed the square root filter function of a self tuning regulator. ESA

N76-11757# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany).
CONTRIBUTIONS TO PROGRAMMING LANGUAGE THEORY [BEITRAEGE ZUR THEORIE DER PROGRAMMIERSPRACHEN]
Herbert Kopp 1975 117 p refs In GERMAN
(BMFT-GMD-97) Avail: NTIS HC $5.50

The basics of the programming language theory developed by G.Hotz was further explored. A concept of semantics, also applicable to the description of complicated programming techniques, was developed. One aspect of semantics, the interpretation of assignments with statements similar to those for ALGOL, was studied in more detail. The usefulness of concepts represented was tested using an example. Some theoretical investigations of programming systems were carried out based on the above. Some problems related to translation of programming languages were dealt with. ESA

N76-11758# Aerospace Corp., El Segundo, Calif.
TRAJECTORY RECONSTRUCTION PROGRAM MILESTONE 2/3 REPORT. VOLUME 2: EQUATIONS AND LOGIC. PART A: INPUT AND EXECUTIVE MODULES
M. J. Rademacher and W. F. Rearick 10 Jan. 1975 534 p
(Contract F04701-74-C-0075)
(AD-A011939; TR-0075(9320)-3-Vol-2-Pt-A; SAMSO-TR-75-90-Vol-2-Pt-A) Avail: NTIS CSCL 16/2

The Trajectory Reconstruction Program (TRP) system consists of vehicle simulation subprograms designed and written in FORTRAN for CDC 6600/7600, IBM 360/370, and UNIVAC 1108/1110 series computers. The overall simulation system has been designed to accommodate extreme variations in vehicle configuration, flight profile, and mission objective and to provide a fast reaction to specific simulations at minimal cost. This simulation system consists of a family of computer subprograms from which a judicious selection can be made to form a specific simulation system for a particular simulation task. Two major design features of the TRP system make it general and versatile. Its modular construction concept (each module contains several models) allows the user to choose those suited to his simulation. Variations in flight profile are accommodated by input at event times only. This document is published in two volumes. Volume I provides a basic review of the functional design, input data philosophy, capabilities, and interface details. Volume II: Equations and Logic is published in three parts for user convenience. Information needed for day to day TRP operation is provided in the Milestone 7 Report, which is published as TR-0075(9320)-4. GRA

N76-11759# Informatics, Inc., Rockville, Md.
RADC AUTOMATIC DOCUMENT CLASSIFICATION ON-LINE (RADCOL). PROGRAM DOCUMENTATION, VOLUME 1 Final Report, 22 Jun. 1973 - 31 Jan. 1975
Peter Kurtz May 1975 201 p refs
(Contract F30602-73-C-0350; AF Proj. 4594)
(AD-A011922; TR-75-1594-1; RADC-TR-75-110-Vol-1) Avail: NTIS CSCL 09/2

This document is the final report on the effort devoted to completing an on-line information retrieval system for the Rome Air Development Center, Air Force Systems Command, Griffiss Air Force Base, Rome, New York. Volume I of this report contains

a brief user's manual to enable interested persons to gain access to the on-line system. Two separate areas were covered in detail under this contract. The first area might be broadly termed performance enhancements but covers a wide range of topics both in the analysis and classification system and in the on-line portion. The other area deals with the matter of content-stem updatability. This portion involved studies of the effect of document length on Dennis' measure, speculation on content-stem vocabulary, and design of a series of experiments in content-stem updatability. Also, a new stem-dictionary structure was designed and implemented. GRA

N76-11760# Informatics, Inc., Rockville, Md.
RADC AUTOMATIC DOCUMENT CLASSIFICATION ON-LINE (RADCOL). USER'S MANUAL, VOLUME 2 Final Report, 22 Jun. 1973 - 31 Jan. 1975
Peter Kurtz May 1975 31 p refs
(Contract F30602-73-C-0350; AF Proj. 4594)
(AD-A011923; TR-75-1594-2; RADC-TR-75-110-Vol-2) Avail: NTIS CSCL 09/2

This report documents improvements made to the RADCOL automatic document analysis system and modifications to the on-line portion of RADCOL. A User's manual is included containing reference material and tutorial guidelines. Both the casual user and the serious experimenter will find instructive sections to aid their different but related purposes. GRA

N76-11761# Texas Univ., Austin. Electronics Research Center.
A MODULE INTERFACE SPECIFICATION LANGUAGE
Robert F. Bridge and Edward W. Thompson 3 Dec. 1974 83 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-A012020; TR-163; AFOSR-75-0868TR) Avail: NTIS CSCL 09/2

One particularly critical function in the development of a large software system is the specification, design, control, and documentation of communications between program modules. Problems in this area contribute significantly to the length of time needed for system tests, the difficulty of long-term maintenance, and the lack of system flexibility. Although the state-of-the-art of Software Engineering has made great strides these past few years, the area of intermodule communication is still lacking in engineering tools and methodologies. This technical report presents a recently developed language which can be used to specify, control, and document program intermodule communication. A system named 'BRIDGES' which processes the new specification language is also discussed. GRA

N76-11762# National Bureau of Standards, Washington, D.C.
CODE EXTENSION TECHNIQUES IN 7 OR 8 BITS
1 Jun. 1975 4 p
(COM-75-50393/8; FIPS-Pub-35) Avail: NTIS HC $3.50 HC also available from SOD as C13.52:35 CSCL 09B

This FIPS PUB announces the adoption of the American National Standard X3.41-1974, code extension techniques for use with the 7-bit coded character set of ASCII. This standard specifies methods of extending the 7-bit code of ASCII (FIPS 1), remaining in a 7 bit environment or increasing to an 8 bit environment, building upon the structure of ASCII to describe various means of extending the control and graphic sets of the code. It also describes techniques for constructing codes related to ASCII so as to allow application dependent usage without preventing the interchangeability of their data and describes 8 bit codes for general information interchange in which ASCII is a subset. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N76-11763# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany).
LOOSE COUPLING OF SYSTEM COMPONENTS [LOSE KOPPLUNG VON SYSTEMKOMPONENTEN]
Horst Wedde 1975 129 p refs In GERMAN
(BMFT-GMD-96) Avail: NTIS HC $6.00

Based on Petri nets, essential aspects of computer systems behavior were determined under consideration of the effects of interaction between partial systems, without discussing their internal structure, and with a loose coupling between adjacent components. Algorithms were developed in order to determine the limitations in the capability of a component to attain a certain state under the influence of other components, and the extent to which a state transition is precluded. The concept of the behavior homomorphism was used to discuss a behavior equivalence in describing the coupling structures by more distinct structures. Some typical problems in concurrent or parallel working processes were used to indicate how results of the algorithms may be used in planning. ESA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N76-11764*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
ON THE INTERACTION STRUCTURE OF LINEAR MULTI-INPUT FEEDBACK CONTROL SYSTEMS M.S. Thesis
Poh Kam Wong Sep. 1975 126 p refs
(Grant NGL-22-009-124)
(NASA-CR-145697; ESL-R-625) Avail: NTIS HC $6.00 CSCL 09B

The closely-related problems of designing reliable feedback stabilization strategy and coordinating decentralized feedbacks are considered. Two approaches are taken. A geometric characterization of the structure of control interaction (and its dual) was first attempted and a concept of structural homomorphism developed based on the idea of 'similarity' of interaction pattern. The idea of finding classes of individual feedback maps that do not 'interfere' with the stabilizing action of each other was developed by identifying the structural properties of nondestabilizing and LQ-optimal feedback maps. Some known stability properties of LQ-feedback were generalized and some partial solutions were provided to the reliable stabilization and decentralized feedback coordination problems. A concept of coordination parametrization was introduced, and a scheme for classifying different modes of decentralization (information, control law computation, on-line control implementation) in control systems was developed. Author

N76-11765# Defence Research Establishment Valcartier (Quebec). Research and Development Branch.
USE OF TWO-DIMENSIONAL DIGITAL FOURIER TRANSFORMS FOR IMAGE PROCESSING AND ANALYSIS
J. F. Boulter Jul. 1975 60 p refs
(DREV-4025/75) Avail: NTIS HC $4.50

An interactive image processing system based on a hybrid computer is described. The system was used to investigate image analysis, enhancement and restoration techniques using the two-dimensional digital Fourier transform. Properties of Fourier transformed displays were examined with particular regard to use of the two-dimensional phase spectrum. Directional filters were used to remove certain features from infrared aerial photographs to enhance other structure. Simulated and experimental sonargrams were processed to enhance line components within a given angular range of the time axis. Images degraded by simulated time-averaged transmission through atmospheric turbulence (Gaussian resolution function) followed by the addition of random noise were restored according to a conventional and an adaptive least-mean-square error criterion. Author

N76-11766# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
A SELF-TUNING PARAMETER ESTIMATOR
K. J. Aastroem Jul. 1974 17 p refs
(Publ-74/55) Avail: NTIS HC $3.50

A self-tuning estimator for process and noise parameters was discussed, based on least-squares calculations. The recursive estimation algorithm was given and it is shown, on analyzing

the algorithm, that certain convariances have to vanish. A characterization of possible limit points was given. It is shown that the true parameter values form a limit point; in certain cases this is the only limit point. Convergence conditions were considered using differential equations introduced by Ljung. The relations to other methods such as recursive maximum likelihood and model reference methods were covered briefly. ESA

N76-11767# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
SOME RESULTS CONCERNING PERTURBED EVOLUTION OPERATORS WITH APPLICATIONS TO DELAY EQUATIONS
Richard Vinter Aug. 1974 20 p refs
(Publ-74/62) Avail: NTIS HC $3.50

Conditions are given under which the development of an operator differential equation is possible. Perturbed evolution equations in Hilbert space are discussed and the integral Riccati equation and the related optimal control problem are dealt with. The differential Riccati equation is also treated. Results of the investigations are relevant to the study of quadratic control of linear delay equations and, through the dual control problem, to the filtering of linear delay equations. ESA

N76-11768# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
OPTIMAL CONTROL OF NON-SYMMETRIC HYPERBOLIC SYSTEMS IN n VARIABLES ON THE HALF-SPACE
Richard B. Vinter Oct. 1974 30 p refs Sponsored in part by Commonwealth Fund
(Publ-74/63) Avail: NTIS HC $4.00

A quadratic control problem on the finite time interval in connection with a system of hyperbolic differential equations in half space is studied. Mixed boundary value problems for hyperbolic systems are discussed. The control problem is formulated and the existence and uniqueness of an optimal control and its characterization through a variational equality are demonstrated. Optimal control is characterized through the adjoint system and a feedback synthesis of controls is made. Finally, feedback synthesis of the boundary control is carried out for a special case. ESA

N76-11769# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
BOUNDS FOR CLOSED-LOOP TRANSFER FUNCTIONS OF MULTIVARIABLE SYSTEMS
M. Araki and O. I. Nwokah Oct. 1974 14 p refs
(Publ-74/64) Avail: NTIS HC $3.50

A multivariable system $y(s) = G(s)x(s)$, $x(s) = u(s) - F(s)y(s)$ is treated, where G(s) is the transfer matrix of a plant and F(s) that of a controller. The other elements are Laplace transforms of the variables. A theorem is proposed and proved, which gives previous results as special cases, reflects directly the block diagonal structure of G(s), and provides bounds which are locally minimal and have desirable convergence properties. With the method of calculating a given bound, an arbitrary ratio can be assigned to the relative accuracy with which each loop is estimated. However, it needs the calculation of the maximum eigenvalue of a matrix, which may require more computational effort than Rosenbrock's result. ESA

N76-11770# Loughborough Univ. of Technology (England). Dept. of Mathematics.
OPTIMAL CONTROL OF NEUTRAL SYSTEMS
M. A. Connor Jan. 1975 13 p ref
(MATHS-Res-49) Avail: NTIS HC $3.50

The constraint of linearity of the describing equations used in a gradient method for neutral systems is relaxed, and an approach suitable to problems having terminal constraints is presented. ESA

N76-11771# Loughborough Univ. of Technology (England). Dept. of Mathematics.
AUGMENTED PENALTY FUNCTIONS IN OPTIMAL CONTROL PROBLEMS WITH TERMINAL CONSTRAINTS
M. Vlach (Charles Univ., Prague) and M. A. Connor Feb. 1975 11 p refs Sponsored by Brit. Council
(MATHS-Res-52) Avail: NTIS HC $3.50

A systematic method for obtaining the constants in the augmented penalty function approach to optimal control problems with terminal constraints is suggested. Special cases give the results obtained by Miele et al for the mathematical programming problem. It is considered important to recognize that the proposed method is not restricted to any particular algorithm. ESA

N76-11772# Loughborough Univ. of Technology (England). Dept. of Mathematics.
AUGMENTED PENALTY FUNCTIONS AND TIME LAG SYSTEMS
M. A. Connor and M. Vlach (Charles Univ., Prague) May 1975 14 p refs
(MATHS-Res-64) Avail: NTIS HC $3.50

The augmented penalty function techniques of Hestenes and Miele were extended to optimal control problems described by ordinary differential equations. The approach of Vlach and Connor is extended to systems represented by difference-differential equations when the target set consists of functions defined on the last lag interval. ESA

N76-11773# Loughborough Univ. of Technology (England). Dept. of Mathematics.
OPTIMAL CONTROL OF DELAY SYSTEMS WITH A STATE INEQUALITY CONSTRAINT
M. A. Connor Jun. 1975 13 p ref
(MATHS-Res-67) Avail: NTIS HC $3.50

A theory is presented for a difference-differential system based on a gradient method for ordinary differential systems with state space inequality constraints. It is assumed that the first time derivation of the constraint equation contains the control function explicitly. ESA

N76-11774# Loughborough Univ. of Technology (England). Dept. of Mathematics.
COMPUTATION OF OPTIMAL CONTROLS FOR NEUTRAL SYSTEMS BY THE GRADIENT METHOD
S. J. Leese Jul. 1975 29 p refs
(MATHS-Res-69) Avail: NTIS HC $4.00

The implementation of a gradient method of solving neutral optimal control problems is discussed and numerical examples are given. ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-11775# Glasgow Univ. (Scotland). Dept. of Aeronautics and Fluid Mechanics.
NON-LINEAR DIFFERENTIAL EQUATIONS HAVING CUBIC STIFFNESS TERMS
A. W. Babister Aug. 1974 74 p refs
(Rept-7401) Avail: NTIS HC $4.50

The nature of solutions of an autonomous nonlinear second-order differential equation with cubic (and linear) stiffness terms was considered. Trajectories in the phase plane were given for various combinations of signs of the parameters. Limit cycles are shown to occur if the parameters for the linear and cubic stiffness terms have opposite signs, and their stability was investigated. Physical examples of such oscillations (or closely related ones) occur in the analysis of the transient response of large amplitude motions of aircraft and missiles. Y.J.A.

N76-11776# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
CONJUGATE GRADIENT-v-STEEPEST DESCENT
J. C. Allwright Jul. 1974 7 p refs
(Publ-74/51) Avail: NTIS HC $3.50

The effectiveness of conjugate gradient versus steepest descent algorithms was compared. It is shown that the conjugate gradient algorithm is superior to the steepest descent algorithm in that, in the generic case, at each iteration it yields a lower cost than the steepest descent algorithm, when both start at the same point. ESA

N76-11777# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
FINITE DIMENSIONAL OPTIMIZATION
D. Q. Mayne Oct. 1974 30 p refs
(Publ-74/79) Avail: NTIS HC $4.00

Finite dimensional optimization problems of an objective function with an inequality constraint set and an equality constraint set are discussed. Conditions of optimality are dealt with, algorithm models and convergence are discussed, and unconstrained optimization is presented. The rate of convergence is discussed and feasible direction algorithms for constrained optimization problems are given. Finally penalty and barrier function methods are presented and duality aspects are dealt with. ESA

N76-11778# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
BOUNDS UPON NONLINEAR FUNCTIONS FOR CONTROLLABILITY PROBLEMS
A. J. Milbourn Nov. 1974 9 p refs
(Publ-74/80) Avail: NTIS HC $3.50

Relationships are given and compared between some commonly used restrictions upon the three variable vector valued function f(x,u,t), which are pertinent to the null-controllability of: differential of x equals A(t)x(t)+B(t)u(t)+f(x,u,t). Norm bounds, weak linearity conditions, and inner product bounds are discussed. Two examples are given showing that weak linearity does not imply Lipschitz, nor does Lipschitz imply weak linearity. ESA

N76-11779# New York Univ., N.Y. Graduate School of Public Administration.
COMPUTATIONAL METHODS IN SINGLE SERVER QUEUES WITH HYPEREXPONENTIAL ARRIVALS AND SERVICE
Irwin Greenberg 30 Jun. 1975 21 p refs
(Contract N0014-67-A-0467-0028)
(AD-A012401; TR-11) Avail: NTIS CSCL 12/1

A class of submodels to be used in the overall readiness measurement models is the queueing system model. A computational algorithm for single server queues with hyperexponential interarrival and service times is developed and illustrated. GRA

N76-11780# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
PALEY, HADAMARD, AND WALSH FUNCTIONS: INTERRELATIONSHIPS AND TRANSCONVERSIONS Interim Report
David K. Cheng and James J. Liu May 1975 24 p refs
(Grant AF-AFOSR-2809-75; AF Proj. 9749)
(AD-A011801; AFOSR-75-0812TR) Avail: NTIS CSCL 12/1

Paley, Hadamard, and Walsh functions are binary-valued functions which form a complete orthonormal set on the interval (0,1). All of them have been referred to as Walsh functions in the literature, leading to considerable confusion in nomenclature. This report defines and differentiates Paley, Hadamard, and Walsh functions from their expressions as products of Rademacher functions. Their interrelationships and the procedures for converting one function to another are discussed. Methods for determining the sequency from the order of a Paley function and of a Hadamard function are explained. An algorithm providing a simple way for obtaining the sequency vector of high-order Hadamard transform matrices is developed. GRA

N76-11781# Stanford Univ., Calif. Dept. of Computer Science.
ON PACKING SQUARES WITH EQUAL SQUARES
P. Erdos and R. L. Graham Mar. 1975 12 p refs
(Grant NSF GJ-36473; NR Proj. 044-402)
(AD-A011835; SU-STAN-CS-75-483) Avail: NTIS CSCL 12/1

The following problem is discussed which arises in connection with certain multidimensional stock cutting problems: the number of nonoverlapping open unit squares which may be packed into a large square of side alpha. If alpha is a positive integer, it is shown that alpha squared unit squares can be successfully packed. If alpha is not an integer, the problem becomes more complicated. It is proven that the amount of uncovered area can be kept down to at most proportional to alpha (7/11), which for large alpha is much less than the linear waste produced by the 'natural' packing above. Author (GRA)

N76-11782# Naval Research Lab., Washington, D.C.
FINITE DIFFERENCE APPROXIMATIONS AND THEIR STENCIL FORMS OF POISSON'S EQUATION IN CYLINDRICAL COORDINATES
John G. Siambis, Roswell Lee, and Shyke A. Goldstein May 1975 19 p refs
(DNA Proj. NWED-QAXL)
(AD-A011816; NRL-MR-3054) Avail: NTIS CSCL 12/1

A systematic method is presented for finding finite difference approximations and their stencil representation of Poisson type second order partial differential equations in two variables for the purpose of obtaining accurate numerical solutions of these equations. The method uses a Taylor series expansion for the unknown function and its relationship to the known source function. The case of cylindrical coordinates with rectangular meshes is emphasized. Two known and two new stencils are presented. Modifications to stencils adjacent to physical boundaries are considered. GRA

N76-11783# Massachusetts Inst. of Tech., Cambridge.
ALGEBRAIC STRUCTURE AND FINITE DIMENSIONAL NONLINEAR ESTIMATION
Steven I. Marcus and Alan S. Willsky 1975 10 p refs
(Grants AF-AFOSR-2273-72; NSF GK-42090; AF Proj. 9769)
(AD-A012019; AFOSR-75-0910TR) Avail: NTIS CSCL 12/1

Optimal recursive state estimators have been derived for very general classes of nonlinear stochastic systems. The optimal estimator requires, in general, an infinite dimensional computation to generate the conditional mean of the system state given the past observations. This computation involves either the solution of a stochastic partial differential equation for the conditional density or an infinite set of coupled ordinary stochastic differential equations for the conditional moments. However, the class of linear stochastic systems with linear observations and white Gaussian plant and observation noises has a particularly appealing structure, because the optimal state estimator consists of a finite dimensional linear system -- the Kalman-Bucy filter. In this paper the authors exploit the algebraic structure of certain other classes of systems, in order to prove that the optimal estimators for these systems are finite dimensional. GRA

N76-11784# Kentucky Univ., Lexington. Dept. of Statistics.
ROBUSTNESS OF STEIN'S TWO-STAGE PROCEDURE FOR MIXTURES OF NORMAL POPULATIONS
Saul Blumenthal and Z. Govindarajulu Oct. 1974 23 p refs
(Contract N00014-73-A-0385-0001; NR Proj. 042-295)
(AD-A011911; TR-80; ONR-TR-9) Avail: NTIS CSCL 12/1

Explicit expressions for the level of significance and power of Stein's two-stage hypothesis testing procedure are derived when the normal population is mixed with another normal population differing in the mean. Approximate expansions for these expressions have been obtained, and numerical studies of the size have been carried out using the expansions. Some numerical indication of the accuracy of the approximations has also been obtained. It is surmised that Stein's two-stage procedure is quite robust against mixtures of normal populations differing in location parameters. Similar conclusions can be drawn regarding the coverage probabilities of confidence intervals generated by this procedure. GRA

N76-11785# Colorado State Univ., Fort Collins. Dept. of Mathematics.
BAER SUBDESIGNS OF SYMMETRIC BALANCED INCOMPLETE BLOCK DESIGN Interim Report
R. C. Bose and S. S. Shrikhande (Bombay Univ., India) 1975 22 p refs
(Grant AF-AFOSR-2364-72; AF Proj. 9769)
(AD-A012017; AFOSR-75-0870TR) Avail: NTIS CSCL 12/1

If a symmetric balanced incomplete block design (SBIBD) D(m,k, lambda) is a subdesign of another SBIBD D sub 1(v sub 1, k sub 1 lambda), k sub 1 greater than k, then k sub 1 is greater than or equal to (k-1) squared + lambda. When the equality holds D may be called a Baer subdesign of D sub 1. In this case D sub 1 contains a complementary subdesign D,

which is a symmetric group divisible design (SGDD). These designs are discussed. Author

N76-11786# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ADAPTIVE SEQUENTIAL ESTIMATION WITH UNKNOWN NOISE STATISTICS Final Math Lab Series No. 7
Kenneth A. Myers Jan. 1975 31 p refs
(AF Proj. 7071)
(AD-A012013; ARL-75-0215) Avail: NTIS CSCL 12/1

Sequential algorithms are derived for suboptimal adaptive estimation of the unknown state and observation noise statistics simultaneously with the system state. First- and second-order moments of the noise processes are estimated based on noise samples generated from quantities in the usual Kalman filter algorithm. A limited memory formulation is developed for adaptive correction of the a priori statistics which are intended to compensate for time-varying model errors. The new estimators are applied to an orbit determination problem for a near-earth satellite with significant modeling errors. Results indicate that improved state estimates can be obtained at little computational expense when erroneous a priori noise statistics are adaptively corrected in the filter algorithm. GRA

N76-11787# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mathematics and Statistics.
PROBLEMS AND APPROACHES IN DESIGN OF EXPERIMENTS FOR ESTIMATION AND TESTING IN NONLINEAR MODELS
S. Zacks 30 Jun. 1975 38 p refs
(Contract N00014-67-A-0404-0009; NR Proj. 042-276)
(AD-A011912; TR-21) Avail: NTIS CSCL 12/1

A parametric family is considered of distribution functions of a random variable Y, which depends on a known and controllable real (or vector) value x (the experimental level) and on a vector of unknown parameter(s) theta. The experimental level x belongs to a specified experimental region, the objective of the experiment is to estimate a certain nonlinear parametric function omega (theta). An experiment consisting of N trials is considered to be optimal if it maximizes the total amount of information on omega (theta). The basic theory relating the information function to the estimation or testing problems concerning omega (theta) is discussed. It is shown that generally, the optimal designs depend on the values of the unknown parameters theta. Fixed sample, two-stage and sequential designs based on maximum likelihood and a Bayes estimation of theta are considered. Author

N76-11788# Yale Univ., New Haven, Conn.
ON THE UNIFORM ASYMPTOTIC STABILITY OF CERTAIN LINEAR NON-AUTONOMOUS DIFFERENTIAL EQUATIONS
A. P. Morgan and K. S. Narendra May 1975 30 p refs
(Contract N00014-67-A-0097-0; NR Proj. 375-131)
(AD-A011921; CT-64) Avail: NTIS

An ordinary differential equation where P(t) is symmetric positive semi-definite time-varying matrix arises in mathematical control theory. Stability properties (in the sense of Lyapunov) are considered of the equilibrium state x(t) = 0. It is a relatively trivial exercise to show that the origin is stable but (uniform) asymptotic stability does not generally hold unless P(t) is positive definite. The semi-definite case arises more frequently in practice than the definite one; the main effort is directed towards conditions implying uniform asymptotic stability in such a case. Author

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-11789# Gruppe fuer Ruestungsdienste, Bern (Switzerland).
PROBABILITY NET FOR NORMAL DISTRIBUTION, AUTOMATIC RECORDING WITH THE HELP OF A RAPID PRINTER [WAHRSCHEINLICHKEITSNETZ DER NORMALVERTEILUNG, AUTOMATISIERUNG DER EINTRAGUNG MIT HILFE DES SCHNELLDRUCKERS]
O. Kihm and H. Muggli 12 Jul. 1974 23 p In GERMAN; ENGLISH summary
(CH-3602) Avail: NTIS HC $3.50

Both the principle and practical use of probability paper are described. Included is documentation for a FORTRAN subroutine that uses the line printer to plot the distribution function of empirical data in a normal probability paper scale. Some examples and hints to non-normal probability paper are included. Author

N76-11790*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DISTRIBUTION AND MOMENTS OF RADIAL ERROR
Robert G. White 15 Aug. 1975 59 p refs
(NASA-TM-X-64962) Avail: NTIS HC $4.50 CSCL 12A

An investigation of the moments and probability distribution of the resultant of two normally distributed random variables is presented. This is the so-called generalized Rayleigh distribution which has many applications in the study of wind shear, random noise, and radar. The most general formula was derived, and two special cases were considered for which tables of the moments and probability distribution functions are included as an appendix. One of the special cases was generalized to n-dimensions. Author

N76-11791# Manchester Univ. (England). Statistical Lab.
ON THE DISTRIBUTION OF HITS
S. M. Rudolfer Apr. 1975 7 p
(RR-54/SMR/6) Avail: NTIS HC $3.50 CSCL 12A

A marksman fires at a target which consists of s zones. At each stage, he shoots independently of his previous efforts and has a probability p sub o of missing the target which is a function of the probabilities p sub 1,..., p sub s of hitting zones 1,...,s, respectively. The distribution of the number of hits X sub n on the target after n shots was obtained and used to study the marksman's optimal strategy. Author

N76-11792# Loughborough Univ. of Technology (England). Dept. of Mathematics.
ASYMPTOTIC RESULTS FOR CRAMER-VON MISES TYPE STATISTICS FOR GOODNESS-OF-FIT WHEN PARAMETERS ARE ESTIMATED FROM CENSORED DATA
A. N. Pettitt Sep. 1974 34 p refs
(MATHS-Res-47) Avail: NTIS HC $4.00

The Cramer-von Mises type of statistics was modified so that it could be used to test the goodness-of-fit of censored data to a completely hypothesized continuous distribution. The asymptotic theory was developed so that the censored statistics can be used to test for normality when (mu, sigma) is unknown. Asymptotic percentage points of the statistics were found and the asymptotic relative efficiency of components of the Cramer-von Mises statistics was given for alternatives to normality. Two components were seen to act very much like the moment ratio statistics b1 and b2, for detecting respectively the skewness and kurtosis. Author (ESA)

N76-11793# Loughborough Univ. of Technology (England). Dept. of Mathematics.
AN ANDERSON-DARLING TWO-SAMPLE RANK STATISTIC
A. N. Pettitt Jan. 1975 18 p refs
(MATHS-Res-48) Avail: NTIS HC $3.50

Small sample percentage points are given. An approximation is also given for the distribution. The statistic is seen to be related to Wilcoxon's and Mood's rank statistics and asymptotic power comparisons are made with Lepage's combined Wilcoxon Ansari-Bradley statistic for shift in location and scale. Author (ESA)

N76-11794# Harvard Univ., Cambridge, Mass. Dept. of Statistics.
[RESEARCH PROGRESS IN FREQUENCY DISTRIBUTION, VARIANCE ANALYSIS, SAMPLING DESIGN, AND STOCHASTIC PROCESSES] Final Report, 1957 - 1975
William G. Cochran Jun. 1975 17 p refs
(Contract N00014-67-A-0298-0017; NR Proj. 042-097)
(AD-A011365) Avail: NTIS CSCL 12/1

The research areas under this contract have been frequency distributions, estimation, hypothesis testing, relationships, variance analysis, sampling designs, design of experiments, and stochastic processes. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-11795+ Wetenschappelijk en Technisch Documentatie- en Informatiecentrum voor de Krijgsmacht, The Hague (Netherlands).
OPERATIONS RESEARCH 15: BIBLIOGRAPHY
1974 74 p refs Partly in ENGLISH, GERMAN, FRENCH, and DUTCH
(TDCK-65522) Avail: NTIS HC $4.50

A list of 537 selected articles on the theory and applications of operations research is given. The subject divisions on the bulletin and the index are the same. Pages on one subject have been numbered consecutively, so one can put the pages on one subject together for all the title indices published so far.
Author (ESA)

N76-11796*# Scientific Translation Service, Santa Barbara, Calif.
SYMBOLIC PROCEDURES IN MACHINE ANALYSIS AND SYNTHESIS OF AUTOMATIC CONTROL SYSTEMS
L. P. Smolnikov and Ye. T. Razhenkov Washington NASA Oct. 1975 13 p refs Transl. into ENGLISH from Vopr. Teorii Sistem Avtomat. Upr. (USSR), no. 1, 1974 p 94-98
(Contract NASw-2791)
(NASA-TT-F-16640) Avail: NTIS HC $3.50 CSCL 09B

Two classes of methods, symbolic and numerical, are available to specialists in the field of automatic control. In symbolic methods, some of the variables are not assigned numerical values, while in numerical methods, most or all the variables are given numerical values. The advantages are discussed of the symbolic method for analysis and synthesis of automatic control systems. The feasibility of using such methods is discussed. A brief description is given of the computer-based procedures for making calculations on piecewise-linear systems and multidimensional systems. It is estimated that 35-50 standard programs would be needed when using symbolic methods for analysis and synthesis of smooth and piecewise-smooth systems. Author

N76-11797*# Howard Univ., Washington, D.C.
CHANDRASEKHAR-TYPE ALGORITHMS FOR FAST RECURSIVE ESTIMATION IN LINEAR SYSTEMS WITH CONSTANT PARAMETERS Final Report
Ajit K. Choudhury and Mahmood Djalali Sep. 1975 65 p refs
(Grant NsG-9010)
(NASA-CR-145607) Avail: NTIS HC $4.50 CSCL 12A

In this recursive method proposed, the gain matrix for the Kalman filter and the convariance of the state vector are computed not via the Riccati equation, but from certain other equations. These differential equations are of Chandrasekhar-type. The 'invariant imbedding' idea resulted in the reduction of the basic boundary value problem of transport theory to an equivalent initial value system, a significant computational advance. Initial value experience showed that there is some computational savings in the method and the loss of positive definiteness of the covariance matrix is less vulnerable. Author

N76-11798# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A NOTE ON CONTROLLABILITY AND OBSERVABILITY OF COMPOSITE SYSTEMS
A. C. Pugh Mar. 1975 13 p refs
(Grant SRC-B/SR/8561)
(MATHS-Res-57) Avail: NTIS HC $3.50

Some recent results on the controllability and observability of composite systems formed from the connection of two subsystems were shown to be a consequence of a more general theorem. The following types of composite systems were discussed: parallel, tandem, and feedback. Author (ESA)

N76-11799# Oxford Univ. (England). Dept. of Engineering Science.
IDENTIFICATION PACKAGE FOR A PDP-11 COMPUTER
D. W. Clarke [1974] 59 p refs
(OUEL-1113/74) Avail: NTIS HC $4.50

A set of related programs that attempts to produce estimates of linear transfer functions by using experimentally obtained input/output records so that they fit the data in an optimal way is presented. Diagnostic programs that indicate the validity of the models, and display programs that provide engineering insight into the identification process, are included. ESA

N76-11800# Mitre Corp., Bedford, Mass.
DOWNGRADING IN A SECURE MULTILEVEL COMPUTER SYSTEM: THE FORMULARY CONCEPT
D. F. Stork May 1975 64 p refs
(Contract F19628-73-C-0001; AF Proj. 7070)
(AD-A011696; MTR-2924; ESD-TR-75-62) Avail: NTIS CSCL 09/2

The tasks to be performed during the development of the Secure Multilevel Data Base System include the construction of a capability for the transformation of data of higher levels of classification to data at lower levels. The capability is to be part of a system in which access control is based upon a security kernel for the PDP-11/45. In this report a mechanism for facilitating downward transformations is developed, and the impact of the mechanism upon both the Bell-LaPadula model of secure computer systems and the security kernel is discussed. An expository treatment of the model and kernel is also included.
GRA

N76-11801# Ohio State Univ., Columbus. Computer and Information Science Research Center.
EMULATION OF COMPUTER NETWORKS BY MICROPROGRAMMABLE MICROCOMPUTERS
D. Cohen and M. T. Liu Jun. 1974 24 p refs
(Grants NSF GN-5341; NSF GN-27458)
(PB-242912/4; OSU-CISRC-TR-74-4) Avail: NTIS HC $3.50 CSCL 09B

A method is presented of implementing microprogrammable microcomputer systems as a sophisticated tool (emulators) for decreasing the economical risk involved in development of a large computer network. Two levels of emulation are proposed for different networking configurations. The Intel 8080 microprocessors are selected for implementing the systems described. As a special case where mutually exclusive data are processed, the proposed for different networking configurations. The Intel 8080 microprocessors are selected for implementing the systems described. As a special case where mutually exclusive data are processed, the proposed systems can be changed to parallel processing systems for parallel execution processing systems for parallel execution of computer programs at different levels. GRA

N76-11802# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
REDUCTION AND DECOMPOSITION OF LARGE GENERALIZED GEOMETRIC PROGRAMMING PROBLEMS, WITH APPLICATIONS Progress Report, 1 Mar. 1974 - 28 Feb. 1975
E. L. Peterson and R. A. Abrams 1975 11 p refs
(Contract AF-AFOSR-2516-73; AF Proj. 9749)
(AD-A011682; AFOSR-75-0806TR) Avail: NTIS CSCL 12/2

This report is a brief summary of progress by the authors and their associates in their research on the reduction and decomposition of large generalized geometric programming problems and their application for the period 1 March 1974 through 28 February 1975. The problems under study concern (1) the optimal design and operation of hydraulic pipelines, transportation networks, and mechanical and electrical devices, (2) the optimal location of facilities, (3) the analysis and optimal design of structures, and (4) certain aspects of chemical equilibrium, regression analysis, and optimal control. To effectively and efficiently obtain solutions to these problems when stated in geometric programming formulations, methods that ameliorate the complexity of the total system are being developed. These methods center around the ideas of decomposing the total system into smaller subsystems and reducing the dimensionality of the overall system. This summary provides an outline of the most recent results in this research project and provides a listing of publications in which additional detail on the research can be obtained.
GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-11803# Manchester Univ. (England).
THE STRUCTURE OF CERTAIN STATIONARY POINT PROCESSES IN HOMOGENEOUS SPACES
F. Papangelou Aug. 1975 32 p refs
(RR-56/FP/2) Avail: NTIS HC $4.00

An investigation is presented on the theme: if the conditional intensity measure of a point process is the product of two measures, one of which is nonrandom, atomless and infinite, then the process is a Cox process. It is proved that in this case the point process, when conditioned on its remote sigma-field, is Poisson. Once this is established, Point processes in a homogeneous space gamma are considered and it is shown that if gamma has no continuous invariant metric and if a point process in it is stationary under the group acting on gamma and its Campbell measure satisfies a certain condition of absolute continuity, then the conditional intensity measure has a nonrandom factor-measure. Author

N76-11804# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
THE COMPUTATION OF LEUNBERGER CANONICAL FORMS USING ELEMENTARY SIMILARITY TRANSFORMATIONS
K. C. Daly Sep. 1974 11 p refs Sponsored by Sci. Res. Council
(Publ-74/67) Avail: NTIS HC $3.50

Algorithms for computing the four Luenberger canonical forms are presented. Each algorithm uses an appropriate sequence of elementary similarity transformations which can be easily programmed for digital computer usage. Notation and background results are presented. Basic algorithms for transforming a single input system to observable and controllable form, respectively, are derived. These algorithms are generalized to the multivariable case where the order of introduction of columns in the control matrix plays a central role. An analysis of the computational effort of the new algorithms is made and it is concluded that they are considerably better than existing methods. Some examples of the application of the algorithms are presented. ESA

N76-11805# Loughborough Univ. of Technology (England). Dept. of Mathematics.
AN APPROXIMATION THEOREM FOR CONVEX SETS
S. J. Leese Jan. 1975 5 p refs
(MATHS-Res-51) Avail: NTIS HC $3.50

A theorem is presented for arbitrarily close approximation of a compact convex subset by a convex polytope for infinite-dimensional spaces, and an example is given of its application to set-valued functions. ESA

N76-11806# Loughborough Univ. of Technology (England). Dept. of Mathematics.
SEPARATION OF FAMILIES AND OPTIMALITY CONDITIONS
M. Vlach (Charles Univ., Prague) Mar. 1975 22 p refs In UKRAINIAN Sponsored by Brit. Council
(MATHS-Res-56) Avail: NTIS HC $3.50

An approach is considered to optimality conditions, based on the fact that optimality of an element can be expressed by stating that a certain family of sets has an empty intersection. ESA

N76-11807# Loughborough Univ. of Technology (England). Dept. of Mathematics.
MEASURABLE SELECTIONS AND UNIFORMISATION OF SOUSLIN SETS
S. J. Leese Apr. 1975 38 p refs Sponsored by Sci. Res. Council
(MATHS-Res-61) Avail: NTIS HC $4.00

The following problem is dealt with: given two spaces S and X, and a subset A of SxX, when can one find a well-behaved mapping f from piS(A), the projection of A onto S into X such that the graph of f is contained in A? Such a function is called a uniformizing function for A. The problem is of particular interest for applications when S is a measurable space, X is a topological space, and the desired uniformizing function is measurable. Sufficient conditions are given for the set A to be uniformized by a function which is measurable for a wide class of measures on S. ESA

N76-11808# Loughborough Univ. of Technology (England). Dept. of Mathematics.
CONTINUOUS AND BOREL SELECTORS IN NORMED SPACES
S. J. Leese Jul. 1975 16 p refs Sponsored by Sci. Res. Council
(MATHS-Res-68) Avail: NTIS HC $3.50

If S and X are two spaces, a multifunction from S into X is a mapping Gamma which assigns to each point t of S a subset Gamma (t) of X. A function gamma from S into X is called a selector for Gamma. X is assumed to be a normed space and the values Gamma (t) are convex. Under quite general conditions Gamma (t) has a unique point nearest the origin, and the behavior of the selector is investigated. This idea has been used before, but for Lusin-measurable selectors. The previous work on Borel selectors is extended. ESA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-11809*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELASTIC DEFORMATION OF THE GYRO ROTOR IN THE RELATIVITY GYRO EXPERIMENT
Peter B. Eby 3 Nov. 1975 19 p refs
(NASA-TM-X-64964) Avail: NTIS HC $3.50 CSCL 20K

The elastic deformation of a spinning sphere is calculated from first principles. Numerical results are quoted for a quartz sphere spinning at 200 Hz, the most likely configuration for the relativity gyro experiment. The difference in principal moments of inertia is also calculated for the spinning gyro. Author

N76-11810*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LATTICE MODEL THEORY OF THE EQUATION OF STATE COVERING THE GAS, LIQUID, AND SOLID PHASES
N. L. Bonavito, Tomoyasu Tanaka (Ohio Univ., Athens), Eliseo M. Chan (Ohio Univ., Athens), Tsuyoshi Horiguchi (Tohoku Univ., Sendai, Japan), and J. C. Foreman (Computer Sciences - Technicolor Assoc., Seabrook, Md.) Sep. 1975 27 p refs Submitted for publication
(Contract NAS5-20885)
(NASA-TM-X-71009; X-932-75-237) Avail: NTIS HC $4.00 CSCL 11G

The three stable states of matter and the corresponding phase transitions were obtained with a single model. Patterned after Lennard-Jones and Devonshires's theory, a simple cubic lattice model containing two fcc sublattices (alpha and beta) is adopted. The interatomic potential is taken to be the Lennard-Jones (6-12) potential. Employing the cluster variation method, the Weiss and the pair approximations on the lattice gas failed to give the correct phase diagrams. Hybrid approximations were devised to describe the lattice term in the free energy. A lattice vibration term corresponding to a free volume correction is included semi-phenomenologically. The combinations of the lattice part and the free volume part yield the three states and the proper phase diagrams. To determine the coexistence regions, the equalities of the pressure and Gibbs free energy per molecule of the coexisting phases were utilized. The ordered branch of the free energy gives rise to the solid phase while the disordered branch yields the gas and liquid phases. It is observed that the triple point and the critical point quantities, the phase diagrams and the coexistence regions plotted are in good agreement with the experimental values and graphs for argon. Author

N76-11811*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ACTIVE MICROWAVE WORKSHOP REPORT
Richard E. Matthews, ed. Washington 1975 513 p refs Presented at Working Group Meeting on the Util. of Active Microwave Systems in Appl. Programs, Houston, Tex., 22-26 Jul. 1974
(NASA-SP-376; LC-75-600062) Avail: NTIS MF $2.25; SOD HC $5.60

Data from a conference on active microwave systems are summarized. Summaries cover remote sensing of earth/land features, ocean/atmosphere interactions, and equipment and instrument technology. For individual tities, see N76-11812 through N76-11829.

N76-11812* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUMMARY OF THE ACTIVE MICROWAVE WORKSHOP, CHAPTER 1
In its Active Microwave Workshop Report 1975 p 1-39 refs (For availability see N76-11811 02-70)
CSCL 08E

An overview is given of the utility, feasibility, and advantages of active microwave sensors for a broad range of applications, including aerospace. In many instances, the material provides an in-depth examination of the applicability and/or the technology of microwave remote sensing, and considerable documentation is presented in support of these techniques. An assessment of the relative strengths and weaknesses of active microwave sensor data indicates that satisfactory data are obtainable for several significant applications. Author

N76-11813* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACTIVE MICROWAVE REMOTE SENSING OF EARTH/LAND, CHAPTER 2
In its Active Microwave Workshop Report 1975 p 41-67 (For availability see N76-11811 02-70)
CSCL 08G

Geoscience applications of active microwave remote sensing systems are examined. Major application areas for the system include: (1) exploration of petroleum, mineral, and ground water resources, (2) mapping surface and structural features, (3) terrain analysis, both morphometric and genetic, (4) application in civil works, and (5) application in the areas of earthquake prediction and crustal movements. Although the success of radar surveys has not been widely publicized, they have been used as a prime reconnaissance data base for mineral exploration and land-use evaluation in areas where photography cannot be obtained.
Author

N76-11814* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
WATER RESOURCES, CHAPTER 2, PART B
In its Active Microwave Workshop Report 1975 p 67-97 (For availability see N76-11811 02-70)
CSCL 08H

Various applications and projected applications of active microwave instruments for studying water resources. Most applications involve use of an imaging system operating primarily at wavelengths of less than 30 cm (i.e., K-, X-, and L-bands). Discussion is also included concerning longer wavelength nonimaging systems for use in sounding polar glaciers and icecaps (e.g., Greenland and the Antarctic). The section is divided into six topics: (1) stream runoff, drainage basin analysis, and floods, (2) lake detection and fluctuating levels, (3) coastal processes and wetlands, (4) seasonally and permanently frozen (permafrost) ground, (5) solid water resources (snow, ice, and glaciers), and (6) water pollution. Author

N76-11815* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AGRICULTURE, FORESTRY, RANGE, AND SOILS, CHAPTER 2, PART C
In its Active Microwave Workshop Report 1975 p 97-126 (For availability see N76-11811 02-70)
CSCL 08B

The feasibility of using microwave systems in agriculture, forestry, range, and soil moisture measurements was studied. Theory and preliminary results show the feasibility of measuring moisture status in the soil. For vegetational resources, crop identification for inventory and for yield and production estimates is most feasible. Apart from moisture- and water-related phenomena, microwave systems are also used to record structural and spatial data related to crops and forests. E.H.W.

N76-11816* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LAND USE, URBAN, ENVIRONMENTAL, AND CARTOGRAPHIC APPLICATIONS, CHAPTER 2, PART D
In its Active Microwave Workshop Report 1975 p 126-154 refs (For availability see N76-11811 02-70)
CSCL 08B

Microwave data and its use in effective state, regional, and national land use planning are dealt with. Special attention was given to monitoring land use change, especially dynamic components, and the interaction between land use and dynamic features of the environment. Disaster and environmental monitoring are also discussed. E.H.W.

N76-11817* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACTIVE MICROWAVE REMOTE SENSING OF OCEANS, CHAPTER 3 **c48**
In its Active Microwave Workshop Report 1975 p 157-162 (For availability see N76-11811 02-70)
CSCL 08J

A rationale is developed for the use of active microwave sensing in future aerospace applications programs for the remote sensing of the world's oceans, lakes, and polar regions. Summaries pertaining to applications, local phenomena, and large-scale phenomena are given along with a discussion of orbital errors.
Author

N76-11818* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TECHNICAL BACKGROUND, CHAPTER 3, PART B
In its Active Microwave Workshop Report 1975 p 162-181 (For availability see N76-11811 02-70)
CSCL 17I

A description is given of the physics of electromagnetic scattering from the sea and a guideline is presented to relate an observable (such as the radar cross section) to the hydrodynamics or physical properties of the sea. As specific examples of the interdisciplinary science of electromagnetics and geophysical oceanography, the physics is discussed in connection with data provided by three instruments: namely, the scatterometer, the altimeter, and the imaging radar. The data provided by each instrument are discussed in context with specular point and Bragg scattering theories. Finally, the degrading effect of extraneous sources of noise is discussed as a limiting mechanism of the accuracy of the ocean surface measurement. Author

N76-11819* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LOCAL PHENOMENA, CHAPTER 3, PART C **c48**
In its Active Microwave Workshop Report 1975 p 181-191 (For availability see N76-11811 02-70)
CSCL 08J

Oceanic and coastal phenomena with dimensions ranging to 100 km are dealt with. The two major categories discussed are waves, their generation and dynamics and ocean-land related problems. The dynamics, of surface waves in both capillary and gravity ranges indicates that microwave technology provides a superior means of measuring simultaneously the spatial and temporal properties of ocean waves. The need for basic studies of physical phenomena in support of active microwave sensing is indicated. Active microwave scattering from surface waves is discussed in terms of wave dynamics. Author

N76-11820* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE-SCALE PHENOMENA, CHAPTER 3, PART D **c48**
In its Active Microwave Workshop Report 1975 p 192-220 (For availability see N76-11811 02-70)
CSCL 08J

Oceanic phenomena with horizontal scales from approximately 100 km up to the widths of the oceans themselves are examined.

Data include: shape of geoid, quasi-stationary anomalies due to spatial variations in sea density and steady current systems, and the time dependent variations due to tidal and meteorological forces and to varying currents. Author

N76-11821* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TECHNICAL APPROACHES, CHAPTER 3, PART E
In its Active Microwave Workshop Report 1975 p 220-281 refs (For availability see N76-11811 02-70)
CSCL 17I

Radar altimeters, scatterometers, and imaging radar are described in terms of their functions, future developments, constraints, and applications. Author

N76-11822* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACTIVE MICROWAVE SENSING OF THE ATMOSPHERE, CHAPTER 4
In its Active Microwave Workshop Report 1975 p 287-337 (For availability see N76-11811 02-70)
CSCL 17I

The use of active microwave systems to study atmospheric phenomena is studied. Atmospheric pollution, weather prediction, climate and weather modification, weather danger and disaster warning, and atmospheric processes and interactions are covered. E.H.W.

N76-11823* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ADDITIONAL APPLICATIONS AND RELATED TOPICS, CHAPTER 4, PART B
In its Active Microwave Workshop Report 1975 p 337-367 refs (For availability see N76-11811 02-70)
CSCL 20N

Satellite mounted microwave instruments and their use to measure surface pressure are investigated. Data cover instrument accuracy, atmospheric transmission, and meteorological parameter determinations. E.H.W.

N76-11824* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACTIVE MICROWAVE SENSOR TECHNOLOGY, CHAPTER 5
In its Active Microwave Workshop Report 1975 p 369-382 (For availability see N76-11811 02-70)
CSCL 20N

The relationship between surface properties and echo characteristics, as determined by radar technology, is discussed; echo enhancement to reduce measurement uncertainty was included. Feasibility data, suggested baseline functional descriptions of various types of active microwave sensors, and examples of existing radar techniques are summarized. Data manage and measurement processes are also covered. E.H.W.

N76-11825* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EXAMPLES OF CURRENT RADAR TECHNOLOGY AND APPLICATIONS, CHAPTER 5, PART B
In its Active Microwave Workshop Report 1975 p 382-420 (For availability see N76-11811 02-70)
CSCL 17I

Basic principles and tradeoff considerations for SLAR are summarized. There are two fundamental types of SLAR sensors available to the remote sensing user: real aperture and synthetic aperture. The primary difference between the two types is that a synthetic aperture system is capable of significant improvements in target resolution but requires equally significant added complexity and cost. The advantages of real aperture SLAR include long range coverage, all-weather operation, in-flight processing and image viewing, and lower cost. The fundamental limitation of the real aperture approach is target resolution. Synthetic aperture processing is the most practical approach for remote sensing problems that require resolution higher than 30 to 40 m. Author

N76-11826* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A SHUTTLE RADAR MICROWAVE SUBSYSTEM FOR EARTH RESOURCES APPLICATIONS
In its Active Microwave Workshop Report 1975 p 420-450 (For availability see N76-11811 02-70)
CSCL 17I

Microwave subsystem considerations are discussed as a design example for a radar for earth resources applications to be used in conjunction with the shuttle spacelab. This system with a multiplicity of frequencies and polarizations - L-band (25-cm wavelength), S-band (10-cm wavelength), and X-band (3.2-cm wavelength) at two orthogonal linear polarizations - was tentatively selected. The space shuttle vehicle constrains the antenna to approximately 8 m in length and 3 m in width. The frequencies and antenna size comprise the major constraints on the system described, and determine the sensor altitude, coverage, and major hardware parameters. Author

N76-11827* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUBSURFACE SOUNDERS
In its Active Microwave Workshop Report 1975 p 450-478 (For availability see N76-11811 02-70)
CSCL 17A

Airborne or spaceborne electromagnetic systems used to detect subsurface features are discussed. Data are given as a function of resistivity of ground material, magnetic permeability of free space, and angular frequency. It was noted that resistivities vary with the water content and temperature. Author

N76-11828* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DATA MANAGEMENT, CHAPTER 5, PART C c82
In its Active Microwave Workshop Report 1975 p 479-488 (For availability see N76-11811 02-70)
CSCL 05B

The data management for a spacecraft radar was defined in terms of an end-to-end data system, which performs the following three functions: (1) sampling and compaction of data onboard the spacecraft, (2) manipulation of radar data on the ground and (3) conversion of radar measurements to geophysical quantities by means of pattern recognition and other machine techniques. Data processing for imaging radar onboard the spacecraft was examined with the conclusion that several techniques can be used to compact the data before storage. It is recommended that compaction techniques be studied further and that existing aircraft radars be modified to provide digital data so that these compaction techniques can be tested.
Author

N76-11829* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROGRAM PLANNING, CHAPTER 5, PART D c81
In its Active Microwave Workshop Report 1975 p 488-494 refs (For availability see N76-11811 02-70)
CSCL 05A

Recommendations for future activities necessary to support satellite microwave sensing are reported. Areas covered include component development, data processing, calibration, design and fabrication of multifrequency systems, and experimental test programs to establish interactions of electromagnetic waves and sensed parameters. Author

N76-11830# California Univ., Livermore. Lawrence Livermore Lab.
THEORETICAL AND PRACTICAL ASPECTS OF ENERGY STORAGE AND COMPRESSION
O. S. F. Zucker and W. H. Bostick 7 Apr. 1975 24 p refs Presented at Intern. Conf. on Energy Storage, Compression, and Switching, Torino, Italy, 5 Nov. 1974 Sponsored by ERDA (UCRL-76091; Conf-741113-12) Avail: NTIS HC $4.25

The theoretical and experimental aspects of energy storage and compression are reviewed. The role of complementary energy modes combined with nonlinearities in energy compression is described. The need for 'coherent nonlinearity' for efficient compression is emphasized. Various fundamental methods for compressions are described. Quantum mechanical limitations are discussed. Energy storage is reviewed from a theoretical and

practical point of view with emphasis on new approaches.
Author (NSA)

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution.*

N76-11831*# Tufts Univ., Medford, Mass. Dept. of Mechanical Engineering.
SOUND PROPAGATION FROM A SIMPLE SOURCE IN A WIND TUNNEL Final Technical Report, 1 Sep. 1973 - 30 Nov. 1975
John E. Cole, III 30 Nov. 1975 15 p refs
(Grant NGR-22-012-031)
(NASA-CR-145608) Avail: NTIS HC $3.50 CSCL 20A

The nature of the acoustic field of a simple source in a wind tunnel under flow conditions was examined theoretically and experimentally. The motivation of the study was to establish aspects of the theoretical framework for interpreting acoustic data taken (in wind) tunnels using in wind microphones. Three distinct investigations were performed and are described in detail. Author

N76-11832# Joint Publications Research Service, Arlington, Va.
WORKS OF THE FIFTH ALL-UNION SCHOOL-SEMINAR ON STATISTICAL HYDROACOUSTICS (SG-5), PART 1
N. N. Zagoruyko, ed., V. V. Olshevskiy, ed., and S. V. Pasechnyy, ed. 23 Oct. 1975 193 p refs Transl. into ENGLISH of "Trudy Pyatoy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike (SG-5)" Novosibirsk, 1974 p 1-377 Conf. held Novosibirsk, 30 Oct. - 5 Nov. 1973
(JPRS-65999-1) Avail: NTIS HC $7.50

Subject matter includes issues in mathematical description of random field models, statistical measurements, processing of signals on a noise background, and the results of experimental research. Author

N76-11833# Joint Publications Research Service, Arlington, Va.
WORKS OF THE FIFTH ALL-UNION SCHOOL-SEMINAR ON STATISTICAL HYDROACOUSTICS (SG-5), PART 2
N. N. Zagoruyko, ed. 23 Oct. 1975 186 p refs Transl. into ENGLISH from Tr. Pyatoy Vsesoyuznoy Shkoly-Seminara po Statist. Gidroakustike (SG-5) (Novosibirski), 1974
(JPRS-65999-2) Avail: NTIS HC $7.50

Subject matter includes issues in mathematical description of random field models, statistical measurements, processing of signals on a noise background, and the results of experimental research. Author

N76-11834# European Space Agency, Paris (France).
PROPAGATION OF ACOUSTIC WAVES IN A DUCT IN THE PRESENCE OF FLOW
Rene Mutte Sep. 1975 75 p refs Transl. into ENGLISH of "Propagation d'Ondes Acoust. dans un Conduit en Presence d'Ecoulement", ONERA, Paris Report ONERA-NT-221, 1974
(ESA-TT-194; ONERA-NT-221) Avail: NTIS HC $4.50

Turbocompressor noise reduction is studied by considering effects of absorbing materials with resonator structures on turbulent flow accompanied by broadband noise. Experimental studies show that emitted noise frequencies and amplitudes vary with flow velocity and material's characteristics. An attempt is made to explain this phenomenon by a theoretical model found in the pertinent literature. Acoustic waves emitted in a cylindrical duct by N point sources are calculated for the same amplitude, same frequency, but at different relative phases. It is verified experimentally that the acoustic field resulting from the emission of loudspeakers in a cylindrical duct presents actually the expected spatial structure, i.e. a spinning mode structure. This spinning mode simulation device is then used to measure acoustic impedance of a material at oblique incidence. Author (ESA)

N76-11835# Texas Univ., Austin. Applied Research Labs.
SUMMARY OF ENVIRONMENTAL ACOUSTIC DATA PROCESSING Final Report, 1 Sep. - 31 Dec. 1973
Glen E. Ellis 18 Jun. 1975 26 p
(Contract N00014-70-A-0166; NR Proj. 292-131)
(AD-A011836; ARL-TR-75-32) Avail: NTIS CSCL 20/1

This report summarizes the tasks performed under the contract during the period 1 September through 31 December 1973. Descriptions of the continuous wave (cw), ambient noise, and explosive source (SUS) processing systems developed and implemented are provided. The use of these processing systems for the quick-look analyses and volume data processing for the CHURCH GABBRO Exercise is described. GRA

N76-11836# Human Engineering Labs., Aberdeen Proving Ground, Md.
DESIGN STANDARDS FOR NOISE: A REVIEW OF THE BACKGROUND AND BASES OF MIL-STD-1474(MI) Final Report
Georges R. Garinther, David C. Hodge, Gerald Chaikin, and Donald M. Rosenberg Mar. 1975 45 p refs
(AD-A012160; HEL-TM-12-75) Avail: NTIS CSCL 20/1

U.S. Army Human Engineering Laboratory (HEL) Standard S-1-63C (September 1972) was the first design standard for noise in which all previous conflicts between U.S. Army medical guidelines and materiel design criteria were resolved. Its lineal descendent, MIL-STD-1474(MI) (March 1973), was the first design standard for noise in which all Army review activities concurred. This report treats the historical background of Army noise standards, the bases for the noise-limit provisions of MIL-STD-1474(MI), and considerations underlying the specified noise measurement procedures. Appendixes credit the many personnel involved, and an extensive list of references is provided. GRA

N76-11837# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
CHARACTERIZATION OF SONAR TARGETS
P. W. Smith, Jr. 5 May 1975 28 p refs
(Contract N66001-75-C-0056)
(AD-A011918; BBN-TM-244) Avail: NTIS CSCL 17/1

An initial investigation has been made into those characterizations of the strength of sonar target echoes that are relevant to mobile tactical sonars. The primary focus of the investigation is on the statistical characterization of echos, in a format compatible with applications to studies of sonar design and utilization and to mathematical modelling and scaled physical modelling of targets. The sonars whose performance is considered are those characterized by the following chain of elements: signal generator, beamformer, filter (possibly matched filter or correlator), envelope detector and squaring (or equivalent), post-detection integration, decision and display. The parameters of these elements (e.g., resolution time, averaging time) are not specified. GRA

N76-11838# Mississippi Univ., University. Dept. of Physics.
SOUND ABSORPTION AND ENERGY TRANSFER IN GASES Final Report
F. Douglas Shields 15 Sep. 1974 59 p refs
(Contract N00014-70-A-0069)
(AD-A011138) Avail: NTIS CSCL 20/1

A summary is given of work done by the author in seventeen years of contract support by O.N.R. The work of the past year is summarized in two mixtures at 400 and 500K. The second reports the acoustical measurement of thermal and tangential-momentum accommodation coefficients. GRA

N76-11695 Bristol General Hospital (England).
PHYSICAL ASPECTS - ULTRASOUND
B. N. T. Wells *In* AGARD Radiation Hazards Aug. 1975 7 p refs (For availability see N76-11693 02-51)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-11839 Adelphi Univ., Garden City, N.Y.
TRANSITION RADIATION FROM HIGH ENERGY PARTICLES Ph.D. Thesis
Leslie Paul Michelson 1975 145 p
Avail: Univ. Microfilms Order No. 75-15180

The experiment was conducted on a 10 GeV electron synchrotron. Radiators were constructed of 100 uniformly spaced 1 mil aluminum foils with air gaps ranging from 1 to 170 mils. This range permitted a detailed study of the gap formation zone effect which predicts that the total yield due to transition radiation will rise to an asymptotic value with increasing gap. Measurements were taken with each radiator at primary energies of 6.0, 8.0, and 9.8 GeV. The radiation was detected using a lithium-drifted germanium detector, Ge(Li), thus allowing the production of transition radiation to be measured over the entire X-ray spectrum. A simulation, based on theoretical consideration, of the experimental data gathered on the synchrotron was carried out using Monte Carlo techniques. Comparison of experimental and theoretical results revealed excellent agreement in the distribution in energy of deposition in the Ge(Li) detector and in total energy deposition for all radiators and primary energies investigated. Total deposition was found to rise to an asymptotic value with foil spacing as expected. Dissert. Abstr.

N76-11840*# Nebraska Univ., Lincoln.
PHOTOIONIZATION CROSS SECTIONS FOR ATOMIC CHLORINE USING AN OPEN-SHELL RANDOM PHASE APPROXIMATION
Anthony F. Starace and Lloyd Armstrong, Jr. (John Hopkins Univ., Baltimore, Md.) 31 Oct. 1975 50 p refs Sponsored in part by NSF Submitted for publication
(Grant NGR-28-004-021)
(NASA-CR-145606) Avail: NTIS HC $4.00 CSCL 20H

The use of the Random Phase Approximation with Exchange (RPAE) for calculating partial and total photoionization cross sections and photoelectron angular distributions for open shell atoms is examined for atomic chlorine. Whereas the RPAE corrections in argon (Z=18) are large, it is found that those in chlorine (Z=17) are much smaller due to geometric factors. Hartree-Fock calculations with and without core relaxation are also presented. Sizable deviations from the close coupling results of Conneely are also found. Author

N76-11841*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MICROWAVE SPECTRAL LINE LISTING
William F. White Washington Nov. 1975 127 p refs
(NASA-TN-D-8053; L-10377) Avail: NTIS HC $6.00 CSCL 07D

The frequency, intensity, and identification of 9615 spectral lines belonging to 75 molecules are tabulated in order of increasing frequency. Measurements for all 75 molecules were made in the frequency range from 26500 to 40000 MHz by a computer controlled spectrometer. Measurements were also made in the 18000 to 26500 MHz range for some of the molecules. Author

N76-11842# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
ON SHIELDING ESTIMATES FOR MAGNETIC AND NON-MAGNETIC SHIELD MATERIALS
Erling Dahlberg Mar. 1975 44 p refs
(TRITA-EPP-75-05) Avail: NTIS HC $4.00

Some classic shielding formulas for planes, spheres, and cylinders were first given. The usefulness of reciprocity arguments and the duality of magnetic and electric shielding formulas were discussed. The importance of the following parameters was pointed out: mu x delta, D/delta, where mu is the relative permeability, delta the skin depth, and D the shield thickness. For analysis, most shields can be modelled by the assumption that the above parameters are conserved across the surface. The validity of various simplifications for efficient closed shields, which uncouple the source region and the shielded region, was analyzed and illustrated. It is shown that the applicability of shielding results can often be extended by means of direct similarity. Finally, a simple and general shielding formula was derived for an arbitrary current distribution on one side of an effectively infinite plane shield. Author (ESA)

N76-11843# Loughborough Univ. of Technology (England). Dept. of Mathematics.
AN ITERATIVE SCHEME FOR ELECTRONIC SYSTEMS USING ONE-ELECTRON GREEN'S FUNCTIONS
J. Hyslop and D. Rees (Nottingham Univ.) Apr. 1975 18 p refs
(MATHS-Res-59) Avail: NTIS HC $3.50

An iterative generalization of the minimum principle proposed for electronic systems by Hall, Hyslop, and Rees is investigated. It is shown that this generalization still retains the advantage of using members of a larger class of trial wave functions, for example those with discontinuities, as initial approximations to the wave functions. This scheme has the advantage that, at each stage of iteration, an upper bound is obtained which is at least as good as that obtained previously. The theory is first applied to the hydrogen atom. It is then adapted to estimate the Hartree-Fock energy of the helium atom, the Hartree-Fock limit being obtained after a relatively small number of iterations. Author

N76-11844# Loughborough Univ. of Technology (England). Dept. of Mathematics.
THE USE OF SLATER ORBITALS IN VARIATIONAL CALCULATIONS INVOLVING ONE-ELECTRON GREEN'S FUNCTIONS
M. Blakemore, G. A. Evans, and J. Hyslop Jun. 1975 25 p refs
(MATHS-Res-65) Avail: NTIS HC $3.50

The application of a minimum principle by Hall, Hyslop, and Rees is proposed for electronic systems. It is shown that the evaluation of the required two center molecular integrals involving one electron Green's functions may be facilitated by introduction of a particular class of trial functions. These functions incorporate the potential energy of the system as a weighting factor and Slater-type orbitals are then used as a basis set. The evaluation of the resulting integrals is discussed and illustrative calculations for the H2(+) ion are presented. Author (ESA)

N76-11845# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A COMPUTER ANALYSIS OF THE KINETICS OF THE REACTION OF VIBRATIONALLY EXCITED HYDROGEN WITH ATOMIC OXYGEN IN A FLOWING AFTERGLOW EXPERIMENT Interim Report
John H. Birely, Lane A. Darnton, Francis Hai, and Jerome V. V. Kasper 23 Jun. 1975 70 p refs
(AD-A012356; TR-0075(5270-20)-3; SAMSO-TR-75-151) Avail: NTIS CSCL 07/4

A concerted effort was recently undertaken to gain an understanding of vibrational energy on the rate of the process O + H2(1) to OH(+) + H between atomic oxygen and H2 in its v + 1 level to produce vibrationally excited hydroxyl radicals. The purpose of this study was to test the hypothesis that reaction between ambient O and H2(1) exhausted from the rocket engine is responsible for the intense OH(+) emission observed in field measurements on the plume of a missile burning a noncarbon-containing fuel. A flowing afterglow experiment was carried out to study the process at 300K translational temperature. The extensive computer calculations on the kinetics of the O + H2 system that were performed with the Aerospace NEST computer program and have played a vital role in the planning, data acquisition, and analysis phases of the flowing afterglow experiment are presented in this report. A detailed treatment of the kinetics of the O + H2 system is included for several limiting assumptions on the effect of reagent vibrational energy on reaction rates. GRA

N76-11846# United Technologies Research Center, East Hartford, Conn.
INFLUENCE OF COLLISION CROSS-SECTIONS FOR ELECTRONS, ATOMS AND MOLECULAR SYSTEMS Final Report, 1 Apr. 1971 - 31 Mar. 1975
H. Harvey Michels May 1975 53 p refs
(Contract F44620-71-C-0066; AF Proj. 9750)
(AD-A012010; R75-921157; AFOSR-75-0832TR) Avail: NTIS CSCL 07/4

The research performed under this contract was directed toward the analysis of collisional processes involving electrons,

ions, and molecules. These collisional processes are of substantial interest in basic kinetic studies, as well as in a number of engineering applications, particularly in the field of propulsion, chemical laser systems and power generation. Several theoretical approaches to predict kinetic cross-sections have been investigated. Research was performed in the areas of electron-atom, electron-molecule, atom-atom, and molecule-molecule collisions. A chronological list is given of the 8 journal and book publications and 24 invited talks from this program. GRA

N76-11847# California Univ., San Diego. Dept. of Chemistry.
MOLECULAR ALIGNMENT AND PHOTOFRAGMENT SPECTROSCOPY
Joyce H. Ling and Kent R. Wilson 26 Jun. 1975 80 p refs
(Contract N00014-69-A-0200-6020)
(AD-A011985) Avail: NTIS CSCL 07/4

By illumination with polarized light, molecules with a dissociative absorption can be aligned by the selective photodissociation of different M states at different rates. The authors have expanded this technique to neutral molecules, demonstrating it for a diatomic, IBr pumped by the second harmonic of a neodymium laser at 18 780/cm, by observing the recoiling Br fragments with photofragment spectroscopy. Classical and quantum calculations of the selective photodissociation effect give equivalent predictions except in the limit in which only a few M states remain populated. Several methods are discussed for experimentally monitoring the degree of alignment as a function of light flux: (a) the change in fragment flux, (b) the change in relative strength of two transitions of different symmetry as reflected in their joint angular distributions, and (c) the change in the shape of the angular distribution of the recoiling atomic fragments for a single transition. Results show that at achievable light fluxes, molecules with dissociative transitions of moderate strength can be strongly aligned. Molecular populations can be prepared which contain only a few M states for each J, or even only M + or - J. This technique can potentially provide a wide variety of aligned molecules for molecular beam or bulb studies of relaxation as well as elastic, energy transfer and reactive scattering, and can provide further directionality for photon and fragment angular recoil studies. GRA

N76-11848# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
INFRARED STUDIES OF METAL OXIDES UPPER LIMITS OF THE INFRARED OSCILLATOR STRENGTHS OF UO AND UO2 Final Technical Report, 7 Dec. 73 - 1 Oct. 74
Milton J. Linevsky Apr. 1975 13 p refs
(Contract F30602-74-C-0049; ARPA Order 1649; AF Proj. 1649)
(AD-A011732; RADC-TR-75-135) Avail: NTIS CSCL 07/4

Attempts to obtain infrared absorption spectra for UO and UO2 were carried out using a high temperature furnace technique in which these molecules were produced by heating mixtures of uranium and uranium oxide. No observable absorption was obtained in the region of the vibrational fundamentals of these molecules i.e., 1200/cm to 700/cm. Based on these negative observations upper limits for the oscillator strength of UO and UO2 were estimated. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N76-11849+ Wetenschappelijk en Technisch Documentatie- en Informatiecentrum voor de Krijgsmacht, The Hague (Netherlands).
ELECTROMAGNETIC PULSE (EMP): BIBLIOGRAPHY, 1968 - 1974
J. L. M. Naus, comp. and G. E. Oudshoorn, comp. 1974 31 p refs Partly in ENGLISH, GERMAN, and DUTCH
(TDCK-65282) Avail: NTIS HC $4.00

This bibliography of 44 articles on electromagnetic pulses covers literature present at the Netherlands Armed Forces Scientific and Technical Documentation Center under the following chapters: electromagnetic pulse general concepts and electromagnetic pulse protection (general concepts, electronic components, electrical and electronic systems, and communication systems). ESA

N76-11850*# California Univ., Berkeley.
HEAVY ION FRAGMENTATION EXPERIMENTS AT THE BEVATRON Semiannual Report, 1 Apr. - 30 Sep. 1975
Harry H. Heckman 17 Nov. 1975 10 p refs
(Grant NGR-05-003-513)
(NASA-CR-145691; SSL-Ser-16-Issue-69) Avail: NTIS HC $3.50 CSCL 18K

Fragmentation processes of heavy nuclei in matter using the heavy-ion capability of the Bevatron were studied. The purpose was to obtain the single particle inclusive spectra of secondary nuclei produced at 0 deg by the fragmentation of heavy ion beam projectiles. The process being examined is B+T yields F + anything, where B is the beam nucleus, T is the target nucleus, and F is the detected fragment. The fragments F are isotopically identified by experimental procedures involving magnetic analysis, energy loss and time-of-flight measurements. Attempts were also made to: (1) measure the total and partial production cross section for all isotopes, (2) test the applicability of high-energy multi-particle interaction theory to nuclear fragmentation, (3) apply the cross-section data and fragmentation probabilities to cosmic ray transport theory, and (4) search for systematic behavior of fragment production as a means to improve existing semi-empirical theories of cross sections. Author

N76-11851# Tokyo Univ. (Japan). Dept. of Physics.
TRANSVERSE MOMENTUM DISTRIBUTION IN THE NIELSEN AND OLESEN MODEL
S. Sakai Jul. 1975 13 p refs
(TUETP-75-12) Avail: NTIS HC $3.50

The power dependence in the inclusive k sub T distribution at a large k sub T region was derived in the extended hadron model of Nielsen and Olesen without relying upon the hard scattering of hadron constituents. The k sub T dependence behaves approximately like -ln(k sub T) when k sub T is small, then it becomes exp(-a(k sub T) as k sub T increases. Further, it changes to behave like (k sub T) sup (-n(k sub T) when k sub T becomes larger. This k sub T distribution was derived by the strong repulsive force between two vortex-lines (identified as hadron) due to the pressure of the spontaneously broken vacuum state which is necessary to confine the vector field. The model of k sub T distribution is very similar to the production of massive resonances and their successive decay. Author

N76-11852# Nagoya Univ. (Japan). Inst. of Plasma Physics.
AN ENHANCED SCATTERING OF NEUTRALIZED ELECTRON BEAM ALONG MAGNETIC FIELD
Johshin Uramoto Aug. 1975 38 p refs
(IPPJ-228) Avail: NTIS HC $4.00

When a negative radial electric field is applied externally around an electron beam neutralized critically by passing through a neutral gas in a uniform magnetic field, a radial electron current is produced after a Bohm-likely enhanced mobility. In this state, the electron beam is scattered with an axially enhanced collision up to a few per cent of the radial Bohm collision. That collision may be due to a fluctuating ion space charge left behind by the radial enhanced electron current. Author

N76-11853# Joint Publications Research Service, Arlington, Va.
TWENTY YEARS OF ATOMIC ENERGY
I. D. Morokhov, ed. 24 Oct. 1975 315 p Transl. into ENGLISH from Atomnoy Energ. XX Let (Moscow), 1974 p 5-215
(JPRS-66008) Avail: NTIS HC $9.75

A review of the first twenty years of nuclear power engineering in the Soviet Union was presented, including discussions on the following topics: history, design and description of reactors, radiation safety, international implications. Author

74 OPTICS

Includes light phenomena.

N76-11854*# Kanner (Leo) Associates, Redwood City, Calif.
THE DISPERSION OF NaCl IN THE REGION OF ITS NATURAL INFRARED FREQUENCY
R. Geick Washington NASA Nov. 1975 35 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 166, 1962 p 122-147
(Contract NASw-2790)
(NASA-TT-F-16656) Avail: NTIS HC $4.00 CSCL 20F

The reflectivity of a NaCl residual radiation plate in the spectral range from 44-170 micrometer and the transmitting properties of layers of appropriate thickness in the range from 55-170 micrometer were measured. A new method for the determination of the optical constants in the narrow range of the natural infrared frequency -- in this case, of NaCl -- is described. By means of this method, recent measurement results are compiled and the optical constants of NaCl are determined from them. Further, by application of the Kramer's-Kronig relation to the reflectivity of NaCl, the phase increment induced by reflection and the optical constants are calculated. The optical constants determined in a purely experimental manner are compared with calculated values and with recent results of the dispersion theory. Author

N76-11855*# Scientific Translation Service, Santa Barbara, Calif.
DISPERSION MEASUREMENTS ON NaCl, KCl AND KBr BETWEEN 0.3 AND 3mm WAVELENGTH
L. Genzel, H. Happ, and R. Weber Washington NASA Nov. 1975 13 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 154, 1959 p 13-18
(Contract NASw-2791)
(NASA-TT-F-16657) Avail: NTIS HC $8.50 CSCL 20F

For the substances NaCl, KCl and KBr, the transmissivities were measured on plane parallel plates between 0.3 and 3 mm wavelength. The course of the absorption coefficients was determined from those measurements. The dispersion formula stated by Czerny for NaCl was extended by an additional infrared term, so that the entire dispersion curve of the absorption coefficients can be represented with it between 30 microns and 3 millimeters, especially the secondary maximum appearing on the long-wave side of the residual ray principal maximum at 120 microns. Author

N76-11856*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TESTING OF PRINTED CIRCUIT BOARD SOLDER JOINTS BY OPTICAL CORRELATION
Patrick N. Espy Washington Nov. 1975 91 p refs
(NASA-TR-R-449; M-153) Avail:. NTIS HC $5.00 CSCL 20F

An optical correlation technique for the nondestructive evaluation of printed circuit board solder joints was evaluated. Reliable indications of induced stress levels in solder joint lead wires are achievable. Definite relations between the inherent strength of a solder joint, with its associated ability to survive stress, are demonstrable. Author

N76-11857*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
OPTICAL AND INFRARED TRANSFER FUNCTION OF THE GEOS 3 RETROREFLECTOR ARRAY
David A. Arnold Oct. 1975 153 p refs
(Grant NGR-09-015-02)
(NASA-CR-145479; RTOP-161-05-02) Avail: NTIS HC $6.25 CSCL 20F

The transfer function of the retroreflector array carried by the GEOS 3 satellite was computed at three wavelength: 5300, 6943, and 10600 A. The range correction is given for extrapolating laser range measurements to the center of gravity of the satellite. The reflectivity of the array was computed for estimating laser-echo signal strengths. Author

N76-11858# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ELASTIC CONSTANT MEASUREMENTS OF POLYCRYSTALLINE INFRARED WINDOW MATERIALS
S. A. Kulin, R. Salzbrenner, and H. Posen 17 Jun. 1975 21 p refs
(AF Proj. 5620)
(AD-A011653; AECRL-TR-75-0333) Avail: NTIS CSCL 20/6

In this work elastic constants of some infrared window materials were calculated from ultrasonic measurements using a pulse overlap technique. Velocity measurements were determined in various directions in CVD zinc selenide and in hot forged KCl alloy windows. These measurements permitted the determination of Young's Modulus, the shear modulus, the bulk modulus, and Poisson's ratio. Some anistropy was found in the elastic properties of these fabricated or as-grown infrared windows. For example, in the case of the chemically vapor deposited ZnSe which exhibits a small amount of elastic anistropy, the elastic properties were found to be isotropic in all directions normal to the growth direction. The modulus values observed for directions in the plane of the zinc selenide window were found to change by approximately two percent when measured in directions parallel to the plate growth direction. The experimental results obtained were, in some cases, compared with various calculation approximations which yield polycrystalline elasticity parameters from single crystal data. GRA

N76-11859# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
GATING AND CONTRAST-MODULATION RELATED TO ACTIVE COVERT NIGHT PHOTO SYSTEMS
Bruno K. Wernicke May 1975 56 p refs
(AF Proj. 2004)
(AD-A011771; AFAL-TR-74-212) Avail: NTIS CSCL 17/5

An investigation was made to compare the improvement of contrast modulation for different degrees of gated and non-gated Active Night Photo Systems. Illumination sources and sensor are near the same location. The effects of the atmospheric backscatter on the contrast modulation received by the imaging sensor was determined in steps from a fully gated to a non-gated situation. Characteristic curves were derived for several flight altitudes from 2,000 to 23,000 feet and atmospheric conditions of meteorological visibility of 23 Km and 5 Km representing an upper and a lower limit for the most frequently occurring conditions. Specific regions where the contrast modulation decreases at higher rates are shown. GRA

N76-11860# E-Systems, Inc., Greenville, Tex.
TRAP MATS CANOPY MODIFICATION ACCEPTANCE TEST REPORT AND APPENDIX A THROUGH M Test Report, Dec. 1972 - May 1974
David J. McPherson Nov. 1974 231 p
(Contract F04701-71-C-0013; AF Proj. 62627A)
(AD-A011940; G8484.16.23-App-A-M; SAMSO-TR-75-105) Avail: NTIS CSCL 17/8

This document details the results of Acceptance Tests conducted on the TRAP MATS Canopy Modification under Contract F04701-71-C-0013. The body of this report contains a summary of the entire acceptance test program. Details of each individual test are included as appendices. Table 1-1 contains a list of tests conducted and Table 1-2 contains a matrix showing CEI Specification and results. GRA

N76-11861# E-Systems, Inc., Greenville, Tex.
TRAP MATS CANOPY MODIFICATION ACCEPTANCE TEST REPORT. APPENDIX N: FLIGHT ACCEPTANCE TEST, DRUM RESONANCE Test Report, Dec. 1972 - May 1974
David J. McPherson Nov. 1974 444 p refs
(Contract F04701-71-C-0013; AF Proj. 62627A)
(AD-A011941; G8484.16.23-App-N;
SAMSO-TR-75-105-App-N) Avail: NTIS CSCL 17/8

This is the Acceptance Test Report for the TRAP MATS Canopy Modification Program under Contract F04701-71-C-0013 to the U. S. Air Force Space and Missile Organization. The TRAP MATS Canopy Modification Program concerns itself primarily with the development and testing of revolving open aperture drums and a cryogenic cooling system for a state of art radiometric sensor system. This report documents the results of the acceptance tests. GRA

N76-11862# Texas Instruments, Inc., Dallas. Central Research Labs.
THE GaAs OPTICAL STRIPLINE Technical Report, 3 Feb. - 30 Apr. 1975
J. C. Campbell and F. A. Blum 23 May 1975 15 p refs
(Contract N00014-75-C-0501; NR Proj. 009-015)
(AD-A011907; TR-1) Avail: NTIS CSCL 20/6

The research effort during the first quarter of this program began with development of the required metallization techniques; fabrication of high quality, fine geometry optical photomasks; and initial growth of the required epitaxial GaAs. Bringing these things together, the authors have made the first single-stripline modulators achieving 70% amplitude modulation. They have also completed the initial phase of development of the two-stripline switch by fabrication of passive directional couplers with 3 dB coupling lengths as short as 2 mm. GRA

N76-11863# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
INTEGRATED OPTICAL MODULATORS FOR 10 MICRON WAVELENGTHS Final Report, 19 Apr. 1974 - 28 Feb. 1975
D. B. Anderson, R. R. August, J. T. Boyd, and J. E. Coker Mar. 1975 87 p refs
(Contract N00014-73-C-0271; RR01411; NR Proj. 215-216)
(AD-A011916; C73-293.14/501) Avail: NTIS CSCL 20/6

An infrared integrated optics technology for use in the 10 micrometer region of the spectrum has been developed as reported herein comprising the active signal processing modulation functions (temporal and spatial) as may be applied to a CO2 laser transmitter and heterodyne receiver system. Specifically, a traveling wave electro-optic interaction is considered for the phase modulation requirement while a surface elasto-optic is considered for the frequency shifter requirement. The traveling wave electro-optic interaction has employed waveguide field containment in both transverse dimensions to achieve an efficient interaction. The application of the modulation signal has been implemented using both the slot and strip transmission line configurations containing the optical waveguide for phase matching to achieve wide bandwidth. Heteroepitaxial GaAs is employed as the electro-optic material with a heteroepitaxial (GaAl)As alloy as isolation layers on a substrate of high resistivity GaAs. Devices fabricated have been operated as lumped elements and as traveling wave structures and characterized at 1.15 and 10.6 micrometers. GRA

N76-11864# Raytheon Co., Waltham, Mass. Research Div.
CHEMICAL VAPOR DEPOSITION OF CADMIUM TELLURIDE Final Technical Report, 1 Jun. 1973 - 31 Jan. 1975
A. W. Swanson and P. Reagan Mar. 1975 66 p refs
(Contract F33615-73-C-5167; ARPA Order 2421)
(AD-A011723; S-1836; AFML-TR-75-68) Avail: NTIS CSCL 20/6

Cadmium telluride (CdTe) is a promising material for use as high power laser windows. In the fabrication processes used prior to this work difficulties were experienced in controlling the structural perfection and purity of the material. The chemical vapor deposition process offers the promise of overcoming some of the difficulties experienced to date. The first phase involved the investigation of several processes for the CVD of CdTe. The specific processes investigated and evaluated were: (1) dimethyl cadmium and dimethyl tellurium vapors; (2) dimethyl cadmium and tellurium metal vapors; (3) dimethyl cadmium vapor and H2Te gas; (4) cadmium metal and dimethyl tellurium vapors; and (5) Cd and Te vapors; and (6) H2Te gas and Cd vapor. The second phase involved the task of process optimization. The process parameters which were determined to be of importance were: deposition temperature, furnace pressure, and molar ratio of the reactants. The third phase involved the evaluation and measurement of the various process parameters such as deposition rate and profile, as well as the structure and properties of CdTe. GRA

N76-11865# Human Engineering Labs., Aberdeen Proving Ground, Md.
INFANTRY APPLICATIONS OF THE NIGHT VISION GOGGLES, AN/PVS-5. A PILOT STUDY, SEPTEMBER 1974 Final Report
Feb. 1975 81 p refs
(AD-A012164; HEL-TN-3-75) Avail: NTIS CSCL 15/5

Mobility and compatability tests of the AN/PVS-5 night vision goggles for infantry applications were conducted during August 1974 at Aberdeen Proving Ground, MD. Daylight observations of static relationships between the goggles and selected clothing/equipment ensembles were made. In addition, field observations, attitudinal measures and obstacle times are reported for 12 soldiers performing with the goggles at night, in combat ensemble over a 500-meter assault course. Recommendations for improvement of goggle design and further research are provided. GRA

N76-11866# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
DIGITAL PROCESSING OF SYNTHETIC APERTURE OPTICAL IMAGERY Final Technical Report, Oct. 1972 - Dec. 1974
William T. Rhodes Mar. 1975 105 p refs
(Contract F30602-72-C-0409; AF Proj. 9567)
(AD-A011706; RADC-TR-75-58) Avail: NTIS CSCL 20/6

The synthetic aperture approach offers an attractive method for obtaining high resolution imagery with low mass, space-borne optical telescopes. This report presents a simple but effective method which allows the processing of dilute-array synthetic aperture optical data in such a way that aberration effects, introduced by unspecified improper positioning of telescope mirror segments can be removed. It is especially well-suited to two-mirror-segment synthetic aperture telescopes, which are characterized by low mass and comparatively good signal-to-noise ratio characteristics. Although there are restrictions on the spectral bandwidth allowed in the imaging process, the method can nonetheless be applied to multispectral imagery. Adoption of the method to the imaging of astronomical subjects through the turbulent atmosphere is also discussed. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-11867# Nagoya Univ. (Japan). Inst. of Plasma Physics.
FORMATION OF CLOSED MAGNETIC SURFACES BY FORCE-COMPENSATED HELICAL CURRENT
K. Ikuta and Y. Hamada Aug. 1975 8 p refs
(IPPJ-227) Avail: NTIS HC $3.50

An existence of the closed magnetic surface in the torsatron type fusion machine is considered under the condition that the mechanical forces in the helical coils are compensated. The closed magnetic surface is not destroyed by the condition if l greater than or equal to 3, where l is the multipolarity of the helical field. Author

N76-11868# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PRODUCTION OF STRONG CURRENT ION BEAMS IN A NON-UNIFORM MAGNETIC FIELD
Kazunari Ikuta, Akihiro Mohri, and Masaru Masuzaki Jun. 1975 9 p refs
(IPPJ-224) Avail: NTIS HC $3.50

The possibility is discussed of producing strong current ion beams in a magnetic field without neglecting the diamagnetic effect of the drifting electrons across the magnetic field. In certain cases the diamagnetic effect can improve the ion current density. A design of the possible ion beam source is also illustrated. Author

N76-11869# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NUMERICAL ANALYSIS ON STABILITY OF LASER-DRIVEN-PELLET IMPLOSION
T. Yabe (Tokyo Inst. of Technol.) and K. Niu (Tokyo Inst. of Technol.) Jun. 1975 24 p refs
(IPPJ-225) Avail: NTIS HC $3.50

The dynamical stability of the implosion of a laser driven pellet is investigated by using the linearized three dimensional and nonlinear two dimensional hydrodynamic equations. In these

calculations, the following conclusions are obtained: (1) the growth rate of a perturbation is very sensitive to the way how the laser energy is supplied in time into the pellet; (2) the region where the perturbation has a positive growth rate varies with the wave length of the perturbation; (3) the growth of a perturbation is sensitive to the pellet structure; and (4) nonlinear mechanisms have a tendency to stabilize the perturbations.
Author

N76-11870# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RED-SHIFT OF THE FREQUENCY SPECTRA OF HIGH POWER MICROWAVES REFLECTED FROM A MAGNETIZED PLASMA
K. Minami, Y. Mori, and K. Ishii Aug. 1975 18 p refs
(IPPJ-229) Avail: NTIS HC $3.50

Frequency spectra of high-power microwaves reflected from and/or transmitted through a magnetized plasma were measured. Red-shifts of the spectra for reflected waves were observed in cases when the incident microwaves were totally reflected from the plasma. No appreciable frequency shifts were observed in reflected and transmitted waves, when the incident microwaves can transmit through the plasma. The observed red-shifts are attributed to a Doppler-shift effect resulting from a deformation of the plasma column caused by the incident high-power microwaves.
Author

N76-11871# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THERMAL CONDUCTIVITY IN A LASER DRIVEN PELLET
T. Yabe (Tokyo Inst. of Technol.), H. Murakami, and K. Niu (Tokyo Inst. of Technol.) Jul. 1975 27 p refs
(IPPJ-226) Avail: NTIS HC $4.00

The phenomena appearing in a laser driven pellet of a collisionless plasma are numerically simulated on the basis of the one dimensional Vlasov-Poisson equations. The results show that electrons are trapped by the electric fields induced in the region where the temperature gradient exists. This trap of electrons causes a remarkable decrease in the coefficient of the electron thermal conductivity from the value given by Spitzer's formula. Induced magnetic fields will also take part in reducing the thermal conduction in the pellet.
Author

N76-11872# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STABILITY OF OBLIQUE MODULATION ON ION ACOUSTIC WAVE
Masashi Kako and Akira Hasegawa Jun. 1975 13 p refs
(Grant NSF OIP-74-12932)
(IPPJ-223) Avail: NTIS HC $3.50

Modulation on an ion acoustic wave is shown to be unstable in a direction oblique to that of the wave phase velocity.
Author

N76-11873# Colorado Univ., Boulder.
QUASILINEAR DIFFUSION IN INHOMOGENEOUS PLASMAS
D. L. Hooley May 1975 16 p refs
(Contract AT(11-1)-2081)
(COO-2081-25) Avail: NTIS HC $4.00

The problem of inhomogeneous diffusion in a plasma is considered with emphasis on its possible application to relativistic electron beams. A one-dimensional model with a background electrostatic field is used to illustrate the basic approach, which is then extended to a two-dimensional plasma with a background magnetic field. Only preliminary results are available.
Author (NSA)

N76-11874# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
QUASI-STEADY PLASMAS BEING PERMEABLE TO NEUTRAL GAS
B. Lehnert 31 Mar. 1975 63 p refs
(TRITA-EPP-75-06) Avail: NTIS HC $4.50

The penetration of neutral gases into permeable hot plasmas was studied. The basic assumptions made and the equations used are given. Neutral gas penetration into a hot plasma is discussed and the plasma balance in closed magnetic bottles is considered. A subdivision into plasma density regimes was made and density relationships of permeable and impermeable plasmas are given. Heat and pressure balance effects of permeable plasmas were investigated, and finally, Tokamak systems are discussed.
ESA

N76-11875# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
IMPERMEABLE PLASMA TARGETS FOR FUSION REACTIONS
B. Lehnert 2 May 1975 13 p refs
(TRITA-EPP-75-08) Avail: NTIS HC $3.50

Fully ionized impermeable plasma targets which can be created and sustained by the technique of rotating plasmas and similar methods during long time intervals, at ion densities over a hundred times higher than those reached so far in Tokamak experiments are considered. Such plasmas become suitable targets for energetic ion beams producing nuclear fission reactions. Even if these target systems are unlikely to become self sustained fusion reactors, they may provide powerful neutron sources for fusion-fission hybrid reactors.
ESA

N76-11876# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
STABILIZATION OF KINK DISTURBANCES BY INHOMOGENEOUS MAGNETIC FIELDS
T. Hellsten Jan. 1975 27 p refs Revised
(TRITA-EPP-75-01-Rev) Avail: NTIS HC $4.00

With a view to studying a new scheme for magnetic plasma confinements, kink disturbances were investigated for a perfectly conducting cylinder with circular and rigid cross section, placed in the octupole field generated by four external parallel current carrying straight conductors. The inhomogeneous magnetic vacuum field stabilized the disturbances by inductive field changes. This stabilizing effect increased rapidly as conductor positions were made to approach the cylinder. The analysis was performed both in absence and in presence of an axial magnetic field.
Author (ESA)

N76-11877# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron Physics.
ON THE SOLUTION OF THE MODIFIED NAVIER-STOKES EQUATION FOR A MAGNETOHYDRODYNAMIC PROBLEM IN WELDING TECHNOLOGY
Franz Cech Mar. 1975 12 p refs In GERMAN; ENGLISH summary
(TRITA-EPP-75-04) Avail: NTIS HC $3.50

An incompressible, viscous, electrically conducting fluid in the half space above an infinite electrically nonconducting plane is studied to determine the velocity field of the fluid when the electric current produced by a point electrode is led into the plane. A short discussion is given on the question of why earlier theoretical results obtained by other authors do not agree with the experimental observations in welding of the velocity field produced from a current point source.
ESA

N76-11878# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
MINIMUM DRIFT VELOCITY FOR INSTABILITY IN CURRENT-CARRYING, NON-MAXWELLIAN PLASMAS
Volker Jentsch Jul. 1975 33 p refs Sponsored by ESRO
(TRITA-EPP-75-16) Avail: NTIS HC $4.00

The drift velocity which separates stability from instability in current carrying, two component non-Maxwellian plasmas, is analyzed for a sequence of continuous distribution functions with random velocity parameters. By means of the Penrose criterion, the minimum drift is shown to be sensitive not only to the ratio of random energy of electrons and ions but also to the shape of the distribution because of different Landau electron and ion damping. The results may be applicable to low pressure discharge experiments where a two stream situation and related instabilities are present.
Author (ESA)

N76-11879# European Space Agency, Paris (France).
INVESTIGATION OF COLD ANODES IN LOW PRESSURE ARCS WITH SUPERIMPOSED MAGNETIC FIELD
Wolfgang Schall Jul. 1975 78 p refs Transl. into ENGLISH of "Untersuch. kalter Anoden in Niederdruckboegen mit ueberlagertem Magnetfeld", DFVLR, Stuttgart Report DLR-FB-74-73, 13 Nov. 1974 Original German report available from DFVLR, Porz, West Ger. 31 DM

(ESA-TT-179; DLR-FB-74-73) Avail: NTIS HC $5.00

The behavior of the heat losses at the anode of a coaxial magnetoplasmadynamic accelerator with superimposed, longitudinal magnetic field is described and interpreted. According to magnetic field strength, current density, and pressure in the anodic region, the experiments reveal three different operational modes of the arc. These are distinguished by the magnitude of anode fall and heat losses (the latter strongly influenced by the former), by formation of current/voltage instabilities, or by the existence of an arc sport. A different conduction mechanism in the transition region between arc column and anode is ascribed to each operational mode. Author (ESA)

N76-11880# Naval Research Lab., Washington, D.C.
A TEST FOR THE VIABILITY OF FLUID CODES IN THE COLLISIONLESS REGIME Interim Report
W. M. Manheimer, P. Liewer, M. Lampe, R. Clark, and K. R. Chu May 1975 26 p refs
(DNA Proj. NWED-QAXH-C042)
(AD-A011815; NRL-MR-3053) Avail: NTIS CSCL 20/9

A collisionless unmagnetized plasma can multistream. Therefore, it is not clear to what extent fluid codes can be used to describe its motion. A simple test is presented here which shows when a collisionless plasma multistreams. If a temperature equation formulation of the energy equation is used, it is shown that the system continuously and unavoidably loses energy when multistreaming occurs. GRA

N76-11881# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
DENSE PLASMA HEATING AND RADIATION GENERATION Interim Scientific Report
M. Kristiansen and M. O. Hagler 31 Dec. 1974 52 p refs
(Grant AF-AFOSR-2639-74; AF Proj. 9752)
(AD-A011685; SR-1; AFOSR-75-0849TR) Avail: NTIS CSCL 20/9

The investigations under this grant consist of three parts: CO2 laser heating of dense preformed plasmas, interaction of a dense hot plasma with a small solid pellet, and pulsed power systems and technology. The laser plasma heating experiment has demonstrated both beam guiding by the plasma and plasma heating by the beam. These results will be useful in heating plasmas for radiation generation. Experiments have shown that the pellet-plasma interaction can be enhanced by irradiating the pellet with a laser shortly before the interaction begins. This result is relevant to improving the efficiency with which the energy in a hot dense plasma can be converted to radiation. The pellet-plasma interaction effort also includes several sub-investigations related to pulsed power technology development. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N76-11882*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
SKYLAB M518 MULTIPURPOSE FURNACE CONVECTION ANALYSIS Final Report
S. V. Bourgeois and L. W. Spradley Sep. 1975 85 p refs
(Contract NAS8-27015)
(NASA-CR-144036; LMSC-HREC-TR-D496534) Avail: NTIS HC $5.00 CSCL 20B

An analysis was performed of the convection which existed on ground tests and during skylab processing of two experiments: vapor growth of IV-VI compounds growth of spherical crystals. A parallel analysis was also performed on Skylab experiment indium antimonide crystals because indium antimonide (InSb) was used and a free surface existed in the tellurium-doped Skylab III sample. In addition, brief analyses were also performed of the microsegregation in germanium experiment because the Skylab crystals indicated turbulent convection effects. Simple dimensional analysis calculations and a more accurate, but complex, convection computer model, were used in the analysis. Author

N76-11883*# Alabama Univ., Huntsville. Dept. of Physics.
ELECTRICAL CHARACTERIZATION OF GaAs SINGLE CRYSTAL IN DIRECT SUPPORT OF M555 FLIGHT EXPERIMENT Final Technical Report
J. G. Castle Sep. 1975 65 p refs
(Contract NAS8-29542)
(NASA-CR-144049) Avail: NTIS HC $4.50 CSCL 20B

The exploration of several nondestructive methods of electrical characterization of semiconductor single crystals was carried out during the period ending May 1974. Two methods of obtaining the microwave skin depth, one for the mapping flat surfaces and the other for analyzing the whole surface of small single crystal wafers, were developed to the stage of working laboratory procedures. The preliminary 35 GHz data characterizing the two types of space-related single crystal surfaces, flat slices of gallium arsenide and small wafers of germanium selenide, are discussed. A third method of nondestructive mapping of donor impurity density in semiconductor surfaces by scanning with a light beam was developed for GaAs; its testing indicates reasonable precision at reasonable scan rates for GaAs surfaces at room temperature. Author

N76-11884*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MOESSBAUER STUDIES IN Zn(2+)0.3 Mn(2+)0.7 Mn(3+) (2-y) Fe(3+) (2-y) O4
R. G. Gupta (Indian Inst. of Tech., New Delhi), R. G. Mendiratta (Indian Inst. of Tech., New Delhi), and W. T. Escue Aug. 1975 32 p refs
(NASA-TM-X-64961) Avail: NTIS HC $3.75 CSCL 20L

The Mossbauer effect has proven to be effective in the study of nuclear hyperfine interactions. Ferrite systems having the formula (Zn(2+)0.3)(Mn(2+)0.7)(Mn(3+)y)(Fe(3+)2-y)(O4) were prepared and studied. These systems can be interpreted as mangacese-doped zinc and a part of iron ions. A systematic study of these systems is presented to promote an understanding of their microstructure for which various theories were proposed. Author

N76-11885*# Alabama Univ., Huntsville.
ELECTRICAL CHARACTERIZATION OF GaAs SINGLE CRYSTAL IN DIRECT SUPPORT OF M555 FLIGHT EXPERIMENT
J. G. Castle Oct. 1975 61 p refs
(Contract NAS8-29542)
(NASA-CR-143986) Avail: NTIS HC $4.50 CSCL 20L

An exploration of several nondestructive methods of electrical characterization of semiconductor single crystals was carried out. Two methods of obtaining the microwave skin depth, one for mapping flat surfaces and the other for analyzing the whole surface of small single crystal wafers, were developed to the stage of working laboratory procedures. The preliminary 35 GHz data characterizing the two types of space related single crystal surfaces, flat slices of gallium arsenide and small wafers of germanium selenide, are discussed. A third method of nondestructive mapping of donor impurity density in semiconductor surfaces by scanning with a light beam was developed for GaAs; its testing indicates reasonable precision at reasonable scan rates for GaAs surfaces at room temperature. Author

N76-11886# Temple Univ., Philadelphia, Pa. Dept. of Chemistry.
A STUDY OF THE MECHANISM OF PYROELECTRICITY IN POLYMER FILMS Final Report
B. Oh, A. I. Baise, R. E. Salomon, and M. M. Labes Jan. 1975 115 p refs
(Contract DAAK02-74-C-0113)
(AD-A012274) Avail: NTIS CSCL 20/12

A study was undertaken of both theoretical and experimental aspects of the phenomenon of pyroelectricity in polymer films, focussing on polyvinylidene fluoride. Four theoretical models were considered in detail: a rigid rod model; a perimeter of separation model; a molecular rearrangement model; and a space charge model. Experimental studies developed some methods which may be useful in obtaining mechanistic information, and

also determined that a copolymer of vinylidene fluoride and tetrafluoroethylene had a significantly larger pyroelectric coefficient than polyvinylidene fluoride homopolymer. GRA

N76-11887# Westinghouse Research Labs., Pittsburgh, Pa.
FLAT PANEL DISPLAY Final Report, 1 May 1972 - 23 Feb. 1973
T. P. Brody, D. H. Davies, F. C. Luo, E. W. Greeneich, and G. D. Dixon Nov. 1974 99 p refs
(Contract F33615-72-C-2013; AF Proj. 6090)
(AD-A012294; AFAL-TR-74-301) Avail: NTIS CSCL 09/5

A 100 x 100 element, 6-inch square, liquid crystal (LC) display was developed that is capable of presenting alphanumeric and graphical information. The display is operated in the transmissive mode using twisted nematic LC material. An alignment technique was devised that yielded excellent homogeneous alignment of the LC material over the whole 6 x 6 inch area. The problem of electrically addressing the individual elements was solved using a thin-film, field-effect transistor (TFT) at each X-Y junction. The individual TFT devices exhibited excellent electrical properties and the TFT array was largely free of defects and crosstalk. An electronic exerciser was constructed to test the operation of the panel at TV rates. Although the slow response time of the twisted nematic LC material precluded video imaging, high-quality alphanumeric displays were demonstrated with good contrast and legibility. GRA

N76-11888# Manitoba Univ., Winnipeg. Dept. of Physics.
MAGNETIC RELAXATION EFFECTS IN PrCo5 AND Sm(x)Nd(1-x)C05INDUCED BY HYDROGEN AND DEUTERIUM Final Report, 3 Dec. 1973 - 30 Sep. 1974
I. Maartense Jan. 1975 37 p refs
(Contract F33615-73-C-5060)
(AD-A011779; AFML-TR-74-277) Avail: NTIS CSCL 20/12

Measurements of the ac susceptibility of PrCo5 powder parallel to its c-axis show the existence of two relaxation processes which are present in samples exposed to hydrogen or deuterium but not in degassed samples. The two relaxations have time constants of 10 sec. at 165K and at 200K and are described by effective activation energies of 0.37 eV and 0.51 eV, respectively. Sm(x)Nd(1-x)Co(x) crystals treated with hydrogen show a magnetic relaxation equivalent to the higher energy process in PrCo5; between -20C and 50C, a strong Barkhausen effect dominates the magnetic behavior. GRA

N76-11889# GTE Labs., Inc., Waltham, Mass.
LOW ENERGY ION ELECTRON LUMINESCENCE: A NEW TECHNIQUE FOR THE EXCITATION OF INORGANIC PHOSPHORS
Jerry Kramer Dec. 1974 41 p refs
(Contract N00014-74-C-0315)
(AD-A011877; TR-1) Avail: NTIS CSCL 20/12

A new technique for the excitation of inorganic phosphors by low kinetic energy ions (-40 eV) and low kinetic energy electrons (-20 eV) has been demonstrated and characterized. The characteristic light output of the phosphor has been used as a probe of the excitation mechanism. An empirical relationship between the light output and the ion and electron currents has been determined and used to ascertain the change in light output as a function of ion and electron kinetic energy and ionization potential. The excitation mechanism starts with the formation of holes by the ion beam. Although the holes are mobile in the lattice, some of the holes get trapped. In a second step electrons interact with these trapped holes to create an excited state(s) of the phosphor. Energy is transferred to the luminescent centers resulting in the characteristic emission of the phosphor. The slow or rate-limiting step in the production of light by low energy ions and electrons is the emission of light. GRA

N76-11890# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
ENERGY TRANSFER AND PICOSECOND RELAXATION PROCESSES IN CONDENSED SYSTEMS Final Report, 1 Jun. 1971 - 30 Jun. 1974
D. L. Dexter May 1975 15 p refs
(Contract F33615-71-C-1820; AF Proj. 7885)
(AD-A012208; ARL-75-0114) Avail: NTIS CSCL 20/12

This report contains a brief summary of research performed on optical and mechanical properties of solids, including energy transfer and photo-ionization. The topics discussed include core (X-ray) excitons, effects of magnetic fields on excitons in many-valley semiconductors, simultaneous and cooperative absorption of a photon and energy transfer, effects to be expected because of non-infinite vibrational relaxation rates, a new method for generating sum-rules, and some remarkable products thereof, the angular distribution of electrons in the photo-ionization of polyatomic molecules, and librons in solid N2. GRA

N76-11891# Army Foreign Science and Technology Center, Charlottesville, Va.
SURFACE IONIZATION OF LITHIUM ON THE 110 AND 111 FACES OF A TUNGSTEN SINGLE CRYSTAL
K. Zh. Zhanabergenov and E. P. Sytaya 13 Dec. 1974 8 p refs Transl. into ENGLISH from Nauchn. Tr. Tashkentsk. Gos. Univ. (Tashkent), no. 393, 1971 p 247-253
(AD-A012204; FSTC-HT-23-164-75) Avail: NTIS CSCL 07/4

Equipment and procedures are described for study of the positive surface ionization of sodium and lithium on uniform surfaces and of sodium on incandescent filaments, in a vacuum of (1-2) X 10 to the -9th power torr. Schottky and Richardson curves and ion current vs. temperature curves are presented. The results are explained by an increase in work function of the surface being studied, with light coatings of sodium and lithium adatoms. GRA

N76-11892# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
INVESTIGATION OF TECHNICAL PROBLEMS GALLIUM ARSENIDE Semiannual Technical Report
Fred H. Eisen, Bryant M. Welch, Cheng P. Wen, and Ricardo R. Zucca 5 Feb. 1975 108 p refs
(Contract F19628-74-C-0038; ARPA Order 2489)
(AD-A011708; SC563.14SATR; AFCRL-TR-75-0093) Avail: NTIS CSCL 20/12

Various technological problems in the development of GaAs microwave devices are covered in this report. The work reported here includes: epitaxial growth of ultra-thin and high-resistivity films, study of the relationship between device performance and material parameters using IMPATT diodes, annealing study of n-n(+) interfaces to improve their electrical properties, growth of semi-insulating substrates and characterization techniques, and study of ion implantation as a tool for microwave device fabrication. GRA

N76-11893# Illinois Univ., Urbana. Materials Research Lab.
COMMENTS ON THE X-RAY EDGE AND RECOIL PROBLEMS
C. P. Flynn Jun. 1975 32 p refs
(Contract N00014-67-A-0305-0027; Grant NSF DMR-72-03026)
(AD-A012362) Avail: NTIS CSCL 20/12

Some particular cases of the X-ray edge and recoil problems were examined. The usual independent-particle theory was evaluated exactly for the case in which the excitation introduces a full virtual level into the conduction band. These results are related to studies of rare gas pair absorption in metals and also afford a comparison with earlier theories. Several aspects of the difficulties introduced by the electron-electron interactions in real metals are also discussed. Author

N76-11894# Texas Univ., Austin. Electronics Research Center.
ELECTRON-NONHOMOGENEOUS MAGNETIZATION INTERACTION IN THIN FILMS OF CADMIUM CHROMIUM SELENIDE
Athanasios J. Syllaios and Dimiter I. Tchernev 15 Aug. 1974 84 p refs
(Contract F44620-71-C-0091; AF Proj. 6813)
(AD-A012021; TR-162; AFOSR-75-0866TR) Avail: NTIS CSCL 20/12

The equations of motion for the electron spin and trajectory are solved in an inhomogeneous magnetic field, such as a magnetic domain wall or a periodic magnetic structure in a ferromagnetic semiconductor. It is found that the electron spin polarization is conserved only for electrons traveling through a magnetization

reversal in a time shorter than the Larmor precession period of the spin around the magnetization vector. There are two different kinds of trajectories. For electron velocities and electric fields smaller than a critical value, the trajectory is cycloidal. When the critical value is exceeded the trajectory is modified drastically. It is concluded that these effects will be best observed in thin films of n-type CdCr2Se4, a high mobility ferromagnetic semiconductor. Thin CdCr2Se4 films were prepared by RF sputtering of stoichiometric mixtures of CdSe - Cr2Se3 and subsequent annealing in Se atmosphere at elevated temperatures. Their electrical and magnetic properties are studied and discussed in view of the above calculations. GRA

N76-11895# National Bureau of Standards, Washington, D.C.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: A BASIC PROGRAM FOR CALCULATING DOPANT DENSITY PROFILES FROM CAPACITANCE VOLTAGE DATA Final Report, Sep. 1972 - Sep. 1974
Richard L. Mattis Jun. 1975 43 p Sponsored in part by DNA
(COM-75-10711/0; NBS-SP-400-11) Avail: NTIS HC $4.00 HC also available from SOD as C13.10:400-11 CSCL 09A

A computer program is presented which is suitable for calculating dopant density vs. depth profiles from capacitance voltage data for the case of a Gaussian diffused p-n junction diode. The program includes corrections for peripheral capacitance of round or rectangular diodes and back depletion of the space charge region into the diffused layer. Inputs to the program consist of surface dopant density, junction depth, background dopant density in the diffused layer, junction diameter, three scaling parameters, and capacitance-voltage data pairs. Output from the program is in the form of a plot and an optional listing of dopant density as a function of depth. GRA

N76-11896# Pennsylvania State Univ., University Park. Materials Research Lab.
PIEZOELECTRIC MATERIALS WITH POSITIVE ELASTIC CONSTANT TEMPERATURE COEFFICIENTS Final Report, 8 Jan. 1973 - 8 Jan. 1975
G. R. Barsch and R. E. Newnham Apr. 1975 167 p refs
(Contract F19628-73-C-0108; Grant NSF GH-34547; AF Proj. 5635)
(AD-A012096; AFCRL-TR-75-0163) Avail: NTIS CSCL 20/12

In order to search for new temperature compensated materials for surface acoustic wave (SAW) devices with low ultrasonic attenuation ahd high electromechanical coupling, the following theoretical and experimental investigations were carried out: Lattice dynamics of alpha-quartz; Heuristic molecular engineering approach--temperature coefficients of elastic constants, electromechanical coupling factor, ultrasonic attenuation, list of new potentially temperature compensated materials; Crystal growth; Elastic and thermoelastic property measurements--lead germanate, nepheline, berlinite, eulytite, and NaAlSiO4. GRA

N76-11897# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
HIGH TEMPERATURE DEFECT CHEMISTRY OF ALUMINUM OXIDE Final Technical Report, 6 Sep. 1971 - 5 Sep. 1974
F. A. Kroger Apr. 1975 47 p refs
(Contract F33615-72-C-1123)
(AD-A011984; ARL-75-0108) Avail: NTIS CSCL 20/12

The high temperature defect structure of aluminum oxide was investigated by measurements on single crystals containing known amounts of cobalt. These include high temperature measurements of the conductivity and the emf of concentration cells as functions of oxygen pressure and temperature, and low temperature measurements of optical absorption and electron spin resonance. Analysis of the results leads to a defect model dominated by interstitial aluminum and divalent substitutional cobalt, to parameters of thermodynamic constants regulating the formation of point defects and the oxidation-reduction of cobalt from divalent to trivalent and vice versa, and to the position of levels of cobalt in the forbidden gap. A similar model applies to aluminum oxides doped with iron. GRA

N76-11898# Westinghouse Research Labs., Pittsburgh, Pa.
THIN FILM DISPLAY SWITCHES Final Report, 1 Apr. - 12 Dec. 1974
Thomas P. Brody and Karl K. Yu 7 May 1975 41 p refs
(Contract N00014-71-C-0269; NR Proj. 215-169)
(AD-A011390; Rept-75-9G9-PRNTM-R1) Avail: NTIS CSCL 09/5

A thin film transistor with a floating second gate, capable of nonvolatile storage of analog data, was the subject of the investigation. Further development resulted in a closely controlled, reproducible fabrication process and a higher voltage capability. A 40x40 element, 1 inch square matrix, consisting of X-Y addressible memory transistors at each point was designed, laid out using CAD techniques and fabricated in a single vacuum deposition cycle. Mask and substrate registration techniques were also improved, resulting an excellent run-to-run reproducibility of the deposition patterns. By coating the finished memory matrices with an electroluminescent phosphor (Westinghouse hypermaintenance phosphor), providing a common transparent front electrode and sealing with a cover-glass, complete 40 x 40 element storage displays were made. The displays were operable up to 140V peak-to-peak. The EL driving frequencies ranged from 3 to 20 kHz. Writing of information into individual elements was demonstrated by (manual) pulsing of rows and columns. Letters were written into the panel in this manner, and the non-volatile storage of such patterns over periods of excess of 90 minutes was demonstrated. GRA

N76-11899# Office of Naval Research, London (England).
ANNUAL SOLID STATE PHYSICS CONFERENCE (12TH)
Roy F. Potter 8 Apr. 1975 32 p refs Conf. held at Manchester, Engl., 6-8 Jan. 1975
(AD-A010134; ONRL-C-6-75) Avail: NTIS CSCL 20/12

The Twelfth Annual Solid State Physics Conference, held 6-8 January 1975 at the University of Manchester. This report outlines the talks of the twelve invited speakers. In addition, several of the invited talks for a special symposium on liquid crystals and contributed papers on semiconductors are briefly sketched. The program included topics on phase transitions superconductivity, a pendulum analog for Josephson junctions, anisotropic conductivity transitions, light scattering, helium-three phases, the facilities at the Grenoble high flux reactor, interatomic forces and microscopic structural factors, and quantum transport in semiconductors. Appendix I lists all papers and authors. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N76-11900*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE PHOTON GAS FORMULATION OF THERMAL RADIATION
Robert C. Ried, Jr. Washington Nov. 1975 76 p refs
(NASA-TR-R-453; JSC-S-401) Avail: NTIS HC $5.00 CSCL 20M

A statistical consideration of the energy, the linear momentum, and the angular momentum of the photons that make up a thermal radiation field was presented. A general nonequilibrium statistical thermodynamics approach toward a macroscopic description of thermal radiation transport was developed and then applied to the restricted equilibrium statistical thermostatics derivation of the energy, linear momentum, and intrinsic angular momentum equations for an isotropic photon gas. A brief treatment of a nonisotropic photon gas, as an example of the results produced by the nonequilibrium statistical thermodynamics approach, was given. The relativistic variation of temperature and the invariance of entropy were illustrated. Author

N76-11901# Oak Ridge National Lab., Tenn.
COMPUTER SIMULATION OF THE STEAM-GRAPHITE REACTION UNDER ISOTHERMAL AND STEADY-STATE CONDITIONS
D. S. Joy and S. C. Stem May 1975 55 p
(Contract W-7405-eng-26)
(ORNL-TM-4854) Avail: NTIS HC $5.45

A mathematical model was formulated to describe the isothermal, steady-state diffusion and reaction of steam in a graphite matrix. A generalized Langmuir-Hinshelwood equation was used to represent the steam-graphite reaction rate. The model also includes diffusion in the gas phase adjacent to the graphite matrix. A computer program, written to numerically integrate the resulting differential equations, is described. The coupled nonlinear differential equations in the graphite phase are solved using the IBM continuous system modeling program. Classical finite difference techniques were used for the gas-phase calculations. An iterative procedure is required to couple the two sets of calculations. Several sample problems are presented to demonstrate the utility of the model. Author (NSA)

N76-11902# Oxford Univ. (England). Cryogenics Lab.
HEPROP: A COMPUTER PROGRAMME FOR THE THERMODYNAMIC AND THERMOPHYSICAL PROPERTIES OF HELIUM
B. A. Hands Jun. 1975 110 p refs Revised
(OUEL-1121/75-Rev) Avail: NTIS HC $5.50

HEPROP is a set of subprograms used to calculate the thermophysical properties of helium. The thermodynamic properties are derived from the equation of state developed by McCarty, which is valid from about 2K to 1700K, and up to about 100 MPa. By analytical differentiation and integration, pressure, enthalpy, entropy, (dP/dT)rho, (dP/drho)T and CV are calculated as a function of density (rho) and temperature (T). Equations are provided for pressure, liquid density and vapor density at saturation, thus enabling saturation properties to be calculated. In addition, programs were written for Cp, h(fg), S(fg), the velocity of sound and the Joule-Thomson coefficient using standard thermodynamic relationships. HEPROP is stored in a library file in Oxford University's ICL 1906A computer. ESA

N76-11903# Biot (Maurice A.), Brussels (Belgium).
VARIATIONAL THERMODYNAMICS OF VISCOUS COMPRESSIBLE HEAT CONDUCTING FLUIDS
M. A. Biot May 1975 15 p refs
(Contract F44620-71-C-0092)
(AD-A012022; AFOSR-75-0911TR) Avail: NTIS CSCL 20/13

A new variational principle of virtual dissipation generalizing d'Alembert's principle to nonlinear irreversible thermodynamics is applied to compressible heat conducting fluids with Newtonian and non-Newtonian viscosity. The principle is applied in the context of Eulerian formalism where the flow is described with reference to a fixed coordinate system. New concepts of entropy displacement and mass displacement are used as well as a new definition of the chemical potential which avoids the usual ambiguities of the classical thermodynamic approach. The variational principle is used to derive a novel form of field differential equations for the coupled fluid dynamics and convective heat transfer. GRA

N76-11904# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
DETECTING STRUCTURAL HEAT LOSSES WITH MOBILE INFRARED THERMOGRAPHY. PART 2: SURVEY OF PEASE AIR FORCE BASE, PORTSMOUTH, NEW HAMPSHIRE
R. H. Munis, R. H. Berger, S. J. Marshall, and M. A. Bush Jun. 1975 34 p refs
(AD-A012117; CRREL-RR-338-Pt-2) Avail: NTIS CSCL 13/13

During the winter of 1973-74 a mobile infrared thermography system was used to survey housing units and base facilities at Pease Air Force Base, Portsmouth, New Hampshire. This report provides both qualitative and quantitative evidence regarding heat flow out of the eave vents of these housing units. Calculations indicate that a significant amount of heat is being lost in this manner due to inadequate attic (cap) insulation. Possible evidence of incomplete ventilation could explain the presence of condensation in the housing units. Analyses of thermograms are presented to show the possible existence of low and high pressure areas around a structure and how they relate to heat loss. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N76-11905*# Wisconsin Univ., Madison. Space Science and Engineering Center.
MULTIDISCIPLINARY STUDIES OF THE SOCIAL, ECONOMIC AND POLITICAL IMPACT RESULTING FROM RECENT ADVANCES IN SATELLITE METEOROLOGY. VOLUME 6: EXECUTIVE SUMMARY Final Report
Jul. 1975 107 p
(Grant NGL-50-002-114)
(NASA-CR-145617; ISBN-0-299-97057-4) Avail: NTIS HC $5.50 CSCL 05K

An assessment of the technological impact of modern satellite weather forecasting for the United States is presented. Topics discussed are: (1) television broadcasting of weather; (2) agriculture (crop production); (3) water resources; (4) urban development; (5) recreation; and (6) transportation. J.R.T.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-11906+ Wetenschappelijk en Technisch Documentatie- en Informatiecentrum voor de Krijgsmacht, The Hague (Netherlands).
NETWORK PLANNING: BIBLIOGRAPHY, MAY 1969 - OCTOBER 1974
L. Janssen Oct. 1974 61 p refs Partly in ENGLISH, GERMAN, and DUTCH
(TDCK-65431) Avail: NTIS HC $4.50

A bibliography was presented containing a selection of 120 reports and articles on network planning and related topics, and covering the period May 1969 to October 1974. An author index is included. ESA

N76-11907# Naval Postgraduate School, Monterey, Calif.
COMPARING INVENTORY DEMAND FORECASTS
Peter W. Zehna and Charles F. Taylor, Jr. May 1975 55 p refs
(AD-A012419; NPS-55ZE75051) Avail: NTIS CSCL 05/1

Continued efforts to compare exponential smoothing with other alternatives to demand forecasting are summarized. Using stock-out risk at one extreme and oversupply at the other, the effects of variability in forecasting, even when accurate with respect to the mean, are highlighted. Using a normal model, exponential smoothing is identified as a major source of variability. Various forecast methods are compared using simulation relative to mean squared error when mean demand is allowed to vary according to specified patterns. In almost all circumstances, exponential smoothing consistently emerges as a first choice. The same alternatives are compared using real demand data and the results show exponential smoothing and maximum likelihood to be essentially equivalent. GRA

N76-11908# Colorado Univ., Boulder. Dept. of Physics and Astrophysics.
AN EARTH-BASED COORDINATE CLOCK NETWORK Final Report
Neil Ashby Apr. 1975 37 p refs
(Contract NBS-CST-8335)
(COM-75-10740/9; NBS-TN-659) Avail: NTIS HC $4.00 CSCL 14B

Operational procedures are investigated for synchronizing clocks at fixed sites spread around on the earth's surface, to within a 1 nanosecond level of accuracy. Analysis of a number of effects which might affect clock synchronization is carried out within the framework of general relativity. These effects include

the gravitational fields of the earth, sun, and moon, and orbital motion, rotation, and flattening of the earth. It is shown that the only significant effects are due to the gravitational field and rotation of the earth, and motion of the transported clocks. Operational procedures for construction of a synchronized coordinate clock network using light signals and transported standard clocks are discussed and compared. GRA

N76-11909# Army Armament Command, Rock Island, Ill. Systems Analysis Office.
SIMULATION AND ANALYSIS OF THE SERVICE SELECTION OF THE PROCUREMENT AND PRODUCTION DIRECTORATE
Robert C. Banash and George H. Martin May 1975 37 p
(AD-A012156; SAO-Note-3) Avail: NTIS CSCL 15/5

The study was part of a larger investigation into the ALT (Administrative Lead Time) for the Service Section of Procurement and Production P and P) Directorate (WECOM). The purpose of the analysis is to examine the possibility of reducing processing time in terms of methods and personnel resources. The methodology is applicable to the ARMCOM P and P Service Section. GRA

N76-11910# PRC Information Sciences Co., McLean, Va.
EXPERIMENTAL INTERIM RADC MIS SYSTEM Final Report, 5 Mar. 1974 - 5 Mar. 1975
Paul R. Soderholm May 1975 133 p refs
(Contract F30602-74-C-0204)
(AD-A011730; RADC-TR-75-131) Avail: NTIS CSCL 05/1

This report describes the FEMIS System which was designed by RADC as an experimental interim management system to automate various solutions to the Rome Air Development Center's management information support needs. The software operates under GCOS on the Honeywell 600/6000 series computers. The system executes in the time-sharing environment and has the flexibility to use CRTs and hard copy devices, as well as the high-speed off-line printer. The MIS is a data management retrieval tool, and can be used advantageously on fixed record length files. GRA

N76-11666 East African Meteorological Dept., Nairobi (Kenya).
TRAINING IN AGRICULTURAL METEOROLOGY: THE OPERATIONAL VIEWPOINT
R. C. Hills *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 225-232 refs (For availability see N76-11640 02-47)
Copyright.

N76-11667 East African Meteorological Dept., Nairobi (Kenya).
TRAINING IN AGROMETEOROLOGY IN EAMD
A. V. Todorov *In* WMO Agroclimatol. of the Highlands of Eastern Africa 1974 p 232-240 (For availability see N76-11640 02-47)
Copyright.

N76-11829* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROGRAM PLANNING, CHAPTER 5, PART D
In its Active Microwave Workshop Report 1975 p 488-494 refs (For availability see N76-11811 02-70)
CSCL 05A

N76-11926 Joint Publications Research Service, Arlington, Va.
INTERNATIONAL COOPERATION
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 112-122 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 11 p (For availability see N76-11919 02-88)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N76-11911*# Lunar Science Inst., Houston, Tex.
A SHORTCUT TO THE RIDDLE OF THE MOON
Frances B. Waranius and Jody H. Heiken Sep. 1975 4 p refs
(Contract NSR-09-051-001)
(NASA-CR-145748) Avail: NTIS HC $3.50 CSCL 05B

The Lunar Data Information Center which serves as a reference and lending collection is described. The Center incorporates such methods as a classification scheme for mission-oriented documentation, sample photo browse files, lunar feature index, and color coding; a computer-based Moon Literature Bibliography provides search capability. Author

N76-11912# Defense Documentation Center, Alexandria, Va.
DELIMITED AD DOCUMENT INDEX
Jul. 1975 83 p refs
(AD-A011700; DDC/TR-75/5) Avail: NTIS CSCL 05/2

This consolidated index, in AD number order, lists 31,450 technical reports originally accessioned by DDC as limited distribution and/or classified, but later released for public distribution and sale by NTIS (National Technical Information Service). The index covers the last 11 years of unclassified and 16 years of classified document input in the DDC collection. GRA

N76-11913# Naval Ship Research and Development Center, Bethesda, Md. Computation and Mathematics Dept.
PRELIMINARY DESIGN SPECIFICATION FOR THE NAVLIS PILOT NETWORK PROJECT
B. A. Wallis, I. L. Avrunin, H. W. Mangan (Rockwell Intern. Corp., El Segundo, Calif.), and J. R. Carlyle (Rockwell Intern. Corp., El Segundo, Calif.) 1 Apr. 1974 53 p
(AD-A011823; CMD-22-74) Avail: NTIS CSCL 15/5

The NAVLIS Pilot Network Project will consist of the development and implementation of a distributed data base management system operating on the computers and with the data files at Fleet Data Processing Service Center Pacific (DPSCPAC), Fleet Data Processing Service Center Atlantic (DPSCLANT) and the Naval Material Command Support Activity, (NMCSA), Washington, D.C. DPSCPAC will be the master node or executive site of this three node network. Users will interrogate the network from a remote terminal at any location. The master site executive software will control query processing, and determine location of file or files to be queried. Messages will be sent from the master site via telecommunications to the satellite computer. Satellite software will interpret the message, locate appropriate files, retrieve requested information and send results to the master site. Results will be formatted and output to the user at the terminal. The pilot network will serve as a vehicle for testing the technical feasibility of the NAVLIS baseline concept, for testing user reaction and requirements, and for estimating system implementation costs. GRA

N76-11914# IBM Federal Systems Div., Gaithersburg, Md.
NAVY TECHNICAL MANUAL SYSTEM PUBLISHING SUBSYSTEM, FUNCTIONAL OBJECTIVES DEFINITION Final Report
Charles F. Touchton, Henry J. Laue, and William G. Burke, Jr. 6 Jun. 1975 59 p
(Contract N00167-75-C-0036)
(AD-A012232; FSD-75-0118) Avail: NTIS CSCL 05/2

The Navy Technical Manual System (NTMS) is intended to support and improve the preparation, revision, storage, distribution, management and control of Navy technical manuals. This report presents a number of functional objectives for a component of this system, the NTMS Publishing Subsystem. These objectives relate to the TM products which the system is intended to support; the types of material anticipated for these products; a number of system processes which are expected to be associated with

this material; and the organizations and users which are expected to interface with these processes. GRA

N76-11492* National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
EXPECTED SEASAT-A SCIENTIFIC RESULTS
Frank E. Hoge *In its* Seasat-A Sci. Contrib. Jul. 1974 p 57-69 refs (For availability see N76-11482 02-42)
CSCL 05B

N76-11506* Coastal Engineering Research Center, Fort Belvoir, Va.
EXPECTED SCIENTIFIC YIELD OF SEASAT-A AND ITS APPLICATION TO CORPS OF ENGINEERS PROGRAMS
P. G. Teleki *In* NASA, Washington Seasat-A Sci. Contrib. Jul. 1974 p 129-133 (For availability see N76-11482 02-42)
CSCL 05B

N76-11828* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DATA MANAGEMENT, CHAPTER 5, PART C
In its Active Microwave Workshop Report 1975 p 479-488 (For availability see N76-11811 02-70)
CSCL 05B

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-11915# RAND Corp., Santa Monica, Calif.
ESTIMATING LIFE-CYCLE COSTS: A CASE STUDY OF THE A-7D
Marco Fiorello Feb. 1975 65 p
(Contract F44620-73-C-0011)
(AD-A011643; R-1518-PR) Avail: NTIS CSCL 15/5

The report is concerned with the determination of costs incurred in acquiring and owning a weapon system and the data problems associated therewith. Incurred or historical costs can be used to anticipate future costs of operations and support, to compare forecast with incurred costs for evaluating forecasting techniques, or to estimate a weapon system's total life cycle costs (LCC) for use, along with the associated weapon system capability, in force structure planning. The principal objective of the study is to demonstrate the derivation of the life-cycle cost. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N76-11916*# Texas Univ. Health Science Center, Houston. School of Public Health.
REMOTE SENSING UTILITY IN A DISASTER STRUCK URBAN ENVIRONMENT Annual Progress Report, 1 Dec. 1974 - 1 Dec. 1975
Marjorie Rush and Alfonso Holguin 1 Dec. 1975 85 p refs (Grant NGL-44-084-003)
(NASA-CR-145696) Avail: NTIS HC $5.00 CSCL 06F

Standard operating procedures, utilizing remote sensing, are outlined for public health assistance during natural disaster relief operations. A manual to aid decision making for public health authorities is included. Flow charts which show the procedures that need to be implemented during a natural disaster are also included. Emphasis is placed on a preventive approach to the effects of disasters, and specifically to post-disaster problems that relate to public health concerns during the emergency phase of relief. J.R.T.

88 SPACE SCIENCES (GENERAL)

N76-11917*# National Aeronautics and Space Administration, Washington, D.C.
ADDRESS BY JAMES C. FLETCHER, ADMINISTRATOR NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AT THE NATIONAL ACADEMY OF ENGINEERING, WASHINGTON, D.C., 10 NOVEMBER 1975
10 Nov. 1975 16 p
(NASA-News-Release-75-294) Avail: NASA Scientific and Technical Information Facility P. O. Box 8756, Baltimore/Washington International Airport, Md. 21240 CSCL 05A

Future plans and programs of the space agency are discussed. Topics discussed include solar energy, space stations, planetary exploration, interstellar exploration, the space shuttles, and satellites. M.J.S.

N76-11918*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
PHYSICAL AND DYNAMICAL STUDIES OF METEORS. METEOR-FRAGMENTATION AND STREAM-DISTRIBUTION STUDIES Final Report
Zdenek Sekanina and Richard B. Southworth Washington NASA Nov. 1975 99 p refs
(Contract NAS1-11204)
(NASA-CR-2615) Avail: NTIS HC $5.00 CSCL 03B

Population parameters of 275 streams including 20 additional streams in the synoptic-year sample were found by a computer technique. Some 16 percent of the sample is in these streams. Four meteor streams that have close orbital resemblance to Adonis cannot be positively identified as meteors ejected by Adonis within the last 12000 years. Ceplecha's discrete levels of meteor height are not evident in radar meteors. The spread of meteoroid fragments along their common trajectory was computed for most of the observed radar meteors. There is an unexpected relationship between spread and velocity that perhaps conceals relationships between fragmentation and orbits; a theoretical treatment will be necessary to resolve these relationships. Revised unbiased statistics of synoptic-year orbits are presented, together with parallel statistics for the 1961 to 1965 radar meteor orbits. Author

N76-11919# Joint Publications Research Service, Arlington, Va.
SPACE RESEARCH CONDUCTED IN THE USSR IN 1974 COSPAR REPORT, 18TH PLENARY SESSION
Yu. I. Yefremov, ed. 29 Sep. 1975 128 p. Transl. into ENGLISH of the book "Kosmicheskiye Issledovaniya, Vypolnennyye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 p 1-112
(JPRS-65778) Avail: NTIS HC $6.00

Aerospace research which was conducted by the U.S.S.R. in 1974 is reviewed. For individual titles, see N76-11920 through N76-11927.

N76-11920 Joint Publications Research Service, Arlington, Va. **c91**
INVESTIGATIONS OF THE MOON AND PLANETS
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975

p 2-31 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 30 p (For availability see N76-11919 02-88)

Space probe and ground-based observations of the Moon, Mars, and other planets are discussed. Surface and atmospheric characteristics were investigated. D.M.L.

N76-11921 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF COSMIC RAYS, INTERPLANETARY MEDIUM AND EARTH'S MAGNETOSPHERE **c93**
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 32-51 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 20 p (For availability see N76-11919 02-88)

Progress is reported for several areas of Soviet space research, including the geomagnetic and interplanetary magnetic fields, solar and galactic cosmic rays, natural low and very low frequency emissions, and the ionospheric and interplanetary plasmas. D.M.L.

N76-11922 Joint Publications Research Service, Arlington, Va.
INVESTIGATIONS OF PHYSICS OF THE UPPER ATMOSPHERE AND METEOROLOGICAL INVESTIGATIONS **c46**
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 52-73 Transl. into ENGLISH from the book "Kosmicheski Issledovaniya Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 22 p (For availability see N76-11919 02-88)

Satellite and ground observations of the ionosphere are discussed. Electron temperature, low energy electron flux, horizontal ion concentration gradients, and the convection and concentration of the ionospheric plasma were investigated. Meteorological rocket and satellite observations of the upper atmosphere are also considered. D.M.L.

N76-11923 Joint Publications Research Service, Arlington, Va.
MANNED SPACE FLIGHTS **c13**
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 74-80 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 7 p (For availability see N76-11919 02-88)

The Salyut 3 space station is described along with some of the accomplishments of the Soyuz 14, 15, and 16 flights. D.M.L.

N76-11924 Joint Publications Research Service, Arlington, Va.
BIOMEDICAL RESEARCH **c52**
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 81-93 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 13 p (For availability see N76-11919 02-88)

Physiological reactions experienced by cosmonauts aboard the Salyut 3 space station and the Soyuz 14, 15, and 16 flights are discussed. Biological experiments conducted aboard Soyuz 16 and various Cosmos flights are also described. D.M.L.

N76-11925 Joint Publications Research Service, Arlington, Va.
EXOATMOSPHERIC ASTRONOMY **c89**
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 94-111 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 18 p (For availability see N76-11919 02-88)

Cosmic and atmospheric gamma radiation was measured. Solar and cosmic X radiation was also observed, and ultraviolet spectrograms were obtained for several stellar sources. D.M.L.

N76-11926 Joint Publications Research Service, Arlington, Va.
INTERNATIONAL COOPERATION **c81**
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 112-122 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 11 p (For availability see N76-11919 02-88)

Joint space efforts between the U.S.S.R. and other nations are discussed. Areas of research included the physical properties of space, meteorology and aeronomy, communications, biology and medicine. D.M.L.

N76-11927 Joint Publications Research Service, Arlington, Va.
LAUNCHINGS OF SPACE VEHICLES IN THE USSR IN 1974 **c15**
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 123-125 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 3 p (For availability see N76-11919 02-88)

Data on Soviet space vehicle launchings is tabulated for the year 1974. D.M.L.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-11928*# California Univ., Berkeley.
SPECTRAL AND SPATIAL RESOLUTION OF THE 12.8 MICRON Ne 2 EMISSION FROM THE GALACTIC CENTER
E. R. Wollman, T. R. Geballe, J. H. Lacy, C. H. Townes, and D. M. Rank [1975] 19 p refs Sponsored in part by NSF
(Grants NGL-05-003-272; NGR-05-003-452)
(NASA-CR-145629) Avail: NTIS HC $3.50 CSCL 03A

High-resolution spectra of the Ne II 12.8 micron fine-structure line in emission from the galactic center cloud Sgr A West show a line-center LSR radial velocity of + 75 + or - 20 km/sec. and a velocity dispersion of about 200 km/sec. The line has been observed with spectral resolution as high as 0.10/cm and spatial resolution as high as 8 sec. This appears to provide a direct measurement of conditions in the 45 sec. ionized region at the galactic center. The radial velocity and dispersion are more-or-less independent of position and indicate that events as recent as the last 4 million years have given the ionized gas a systematic motion with respect to the massive stellar component of material at the galactic center. An upper limit for the mass approximately equal to four million times the solar mass was obtained from the velocity distribution, with the mass located within 0.8 parsecs of the galactic center. Author

N76-11929*# Joint Publications Research Service, Arlington, Va.
ORION-2: ULTRAVIOLET SPECTRA OF WEAK STARS
G. A. Gurzadyan Washington NASA Oct. 1975 11 p Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 3, May-Jun. 1975 p 2-7
(NASA Order W-13183)
(NASA-TT-F-16588) Avail: NTIS HC $3.50 CSCL 03A

Ten thousand ultraviolet spectra of stars to the 13th magnitude and the first ultraviolet spectrogram of a planetary nebula obtained were obtained in only five days of work in orbit by the Soviet astrophysical observatory Orion-2. Author

N76-11930*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SCIENTIFIC OPERATIONS PLAN FOR THE NASA SPACE TELESCOPE
Donald K. West and S. Richard Costa Nov. 1975 18 p Presented at Am. Astronautical Soc. 21st Ann. Meeting Space Shuttle Missions, 26-28 Aug. 1975 Revised
(NASA-TM-X-70975; X-604-75-239-Rev) Avail: NTIS HC $3.50 CSCL 03A

A ground system is described which is compatible with the

operational requirements of the space telescope. The goal of the ground system is to minimize the cost of post launch operations without seriously compromising the quality and total throughput of space telescope science, or jeopardizing the safety of the space telescope in orbit. The resulting system is able to accomplish this goal through optimum use of existing and planned resources and institutional facilities. Cost is also reduced and efficiency in operation increased by drawing on existing experience in interfacing guest astronomers with spacecraft as well as mission control experience obtained in the operation of present astronomical spacecraft. Author

N76-11931*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

WORKSHOP PAPERS FOR A SYMPOSIUM ON X-RAY BINARIES

Yoji Kondo and Elihu A. Boldt Oct. 1975 408 p refs Symp. held at Greenbelt, Md., 20-22 Oct. 1975

(NASA-TM-X-72919; X-660-75-285) Avail: NTIS HC $11.00

CSCL 03A

Papers concerning X-ray binaries are presented. X-ray sources discussed include: Her X-1, Cen X-3, Cyg X-3, and transient sources. For individual titles, see N76-11932 through N76-11956.

N76-11932* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HER X-1 SPECTRAL EVIDENCE FOR A STRONG MAGNETIC FIELD

Elihu A. Boldt, Stephen S. Holt, Richard E. Rothschild, and Peter J. Serlemitsos *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 5-13 refs Sponsored in part by NSF Submitted for publication (For availability see N76-11931 02-89)

CSCL 03B

The steep high energy cutoff observed in the spectrum for Her X-1 is analyzed in terms of the severely modified Thomson scattering that dominates the radiative transfer in a highly magnetized plasma near the surface of a neutron star. The data are shown to indicate a field of about 10 to the 13th power G near the magnetic poles and the stopping of accreting matter by nuclear collisions in the neighboring plasma. Author

N76-11933* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OSO-8 OBSERVATIONS OF HERCULES X-1

S. H. Pravdo, R. H. Becker, E. A. Boldt, S. S. Holt, R. E. Rothschild, P. J. Serlemitsos, and J. H. Swank *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 21-33 refs (For availability see N76-11931 02-89)

CSCL 03A

The X-ray binary Her X-1 was observed by the GSFC cosmic X-ray detectors aboard OSO-8 between August 26 and September 3, 1975. The data indicate that Her X-1 turned on in its approximately 35-day cycle by 10h UT August 28. The results reported here are based on quick look tapes which contain less than 10% of the total time spent on source. Spectra were observed during different phases of the binary period including the anomalous low state (dip) in X-ray intensity. The normal high spectra is well represented by a power law with a short cutoff above approximately 25 keV. A significant and varying enhancement in the intensity around 6.7 keV is observed, suggesting the presence of an iron line. Absorption is seen in the spectrum immediately following eclipse. The dip spectrum is found to be considerably flattened. Also spectra are presented for different phases of the pulse period. Author

N76-11934* Tubingen Univ. (West Germany). Astronomisches Inst.

CENTAURUS X-3: THE OBSERVATIONAL PICTURE

Horst Mauder *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 39-43 refs (For availability see N76-11931 02-89)

CSCL 03A

X-ray observations of the neutron star Cen X-3 by various astronomers are briefly reviewed including optical light curves and X-ray pulsations. F.O.S.

N76-11935* Tubingen Univ. (West Germany). Astronomisches Inst.

THE INTERPRETATION OF OPTICAL LIGHT VARIATIONS OF CENTAURUS X-3

Horst Mauder *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 45-53 refs (For availability see N76-11931 02-89)

CSCL 03A

The duration of the X-ray eclipse and the amplitude of light variations are discussed in terms of mass ratio for the components of binary stars such as Cen X-3. F.O.S.

N76-11936* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE INTERSTELLAR MATTER COLUMN DENSITY TO CEN X-3

C. Ryter *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 57-64 refs (For availability see N76-11931 02-89)

CSCL 03A

Cen X-3 is associated with an OB supergiant, and yields of 8.8 x 10 to the 21st power H atoms/sq cm were obtained. The effect of such a column density is easily detectable in the X-ray range. The spectrum exhibits a low energy cut-off, which, according to the usual practice, is parametrized by a column of cold matter, N sub X. The cut-off is definitely observed to be variable and values of N sub X range from approximately 0 to 1.5 x 10 to the 23rd power H atoms/sq cm. There is a suggestion that sometimes N sub X < N sub H. It is concluded that on those occasions a spurious soft X-ray component is present in the source, bearing close similarity with Cyg X-1. When N sub X is large, self-absorption in an optically thick gas is very likely to take place. Author

N76-11937* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OSO-8 GSFC RESULTS ON CEN X-3

J. H. Swank, R. H. Becker, E. A. Boldt, S. S. Holt, S. H. Pravdo, R. E. Rothschild, and P. J. Serlemitsos *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 67-79 refs (For availability see N76-11931 02-89)

CSCL 03A

Spectra of Cen X-3 during eclipse, in transition out of eclipse, and during several later phases of the binary orbit were obtained from quick look data of the July 16-25, 1975 observation by the Goddard X-ray spectroscopy experiment on OSO-8. In the high state there was no absorption turn over. Pulsations were present at least to 23 keV. The spectrum at the pulse minimum was flatter above 7 keV than that of the pulse peak. In transition out of eclipse Cen X-3 emerged above a small low energy flux seen during eclipse. The observations appear to indicate absorption by cold and ionized matter and the presence of iron in the companion's atmosphere. Decreased intensities were observed at late phases of some binary orbits in some cases corresponding to dips. Absorption appears although the low energy component remains. Variable features may be interpretable as absorption and emission by iron and possibly other trace elements. Author

N76-11938* University Coll., London (England). Mullard Space Science Lab.

PULSED X-RAY OBSERVATIONS OF CEN X-3 FROM ARIEL-5

I. R. Tuohy *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 81-94 refs (For availability see N76-11931 02-89)

CSCL 03A

The 4.8 second X-ray pulsations from Centaurus X-3 were monitored by the MSSL collimated proportional counter on board Ariel-5 between 18-27 January, 1975. Analysis of the source Doppler effect shows that the pulsation period of Cen X-3 decreased by 3.70 + or - 0.04 milli-seconds during the preceding 2.3 years. The Doppler analysis also yields updated values for the binary phase and period of Cen X-3. Phase zero occurred at JD 2442438.628 + or - 0.003 and the heliocentric binary period between October, 1972, and January, 1975, was 2.087129 + or - 0.000007 days. Light curves of the 4.8 second pulsations in the 3-9 keV band are presented and are contrasted with previous Uhuru measurements. Author

p 2-31 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 30 p (For availability see N76-11919 02-88)

Space probe and ground-based observations of the Moon, Mars, and other planets are discussed. Surface and atmospheric characteristics were investigated. D.M.L.

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N76-11922 Joint Publications Research Service, Arlington, Va.
INVESTIGATIONS OF PHYSICS OF THE UPPER ATMOSPHERE AND METEOROLOGICAL INVESTIGATIONS **c46**
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 52-73 Transl. into ENGLISH from the book "Kosmicheski Issledovaniya Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 22 p (For availability see N76-11919 02-88)

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N76-11923 Joint Publications Research Service, Arlington, Va.
MANNED SPACE FLIGHTS **c13**
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The Salyut 3 space station is described along with some of the accomplishments of the Soyuz 14, 15, and 16 flights. D.M.L.

N76-11924 Joint Publications Research Service, Arlington, Va.
BIOMEDICAL RESEARCH **c52**
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Physiological reactions experienced by cosmonauts aboard the Salyut 3 space station and the Soyuz 14, 15, and 16 flights are discussed. Biological experiments conducted aboard Soyuz 16 and various Cosmos flights are also described. D.M.L.

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Cosmic and atmospheric gamma radiation was measured. Solar and cosmic X radiation was also observed, and ultraviolet spectrograms were obtained for several stellar sources. D.M.L.

N76-11926 Joint Publications Research Service, Arlington, Va.
INTERNATIONAL COOPERATION **c81**
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 112-122 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 11 p (For availability see N76-11919 02-88)

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N76-11927 Joint Publications Research Service, Arlington, Va.
LAUNCHINGS OF SPACE VEHICLES IN THE USSR IN 1974 **c15**
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 123-125 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 3 p (For availability see N76-11919 02-88)

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Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

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N76-11929*# Joint Publications Research Service, Arlington, Va.
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(NASA-TT-F-16588) Avail: NTIS HC $3.50 CSCL 03A

Ten thousand ultraviolet spectra of stars to the 13th magnitude and the first ultraviolet spectrogram of a planetary nebula obtained were obtained in only five days of work in orbit by the Soviet astrophysical observatory Orion-2. Author

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Donald K. West and S. Richard Costa Nov. 1975 18 p Presented at Am. Astronautical Soc. 21st Ann. Meeting Space Shuttle Missions, 26-28 Aug. 1975 Revised
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operational requirements of the space telescope. The goal of the ground system is to minimize the cost of post launch operations without seriously compromising the quality and total throughput of space telescope science, or jeopardizing the safety of the space telescope in orbit. The resulting system is able to accomplish this goal through optimum use of existing and planned resources and institutional facilities. Cost is also reduced and efficiency in operation increased by drawing on existing experience in interfacing guest astronomers with spacecraft as well as mission control experience obtained in the operation of present astronomical spacecraft. Author

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CSCL 03A

Papers concerning X-ray binaries are presented. X-ray sources discussed include: Her X-1, Cen X-3, Cyg X-3, and transient sources. For individual titles, see N76-11932 through N76-11956.

N76-11932* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HER X-1 SPECTRAL EVIDENCE FOR A STRONG MAGNETIC FIELD

Elihu A. Boldt, Stephen S. Holt, Richard E. Rothschild, and Peter J. Serlemitsos *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 5-13 refs Sponsored in part by NSF Submitted for publication (For availability see N76-11931 02-89)
CSCL 03B

The steep high energy cutoff observed in the spectrum for Her X-1 is analyzed in terms of the severely modified Thomson scattering that dominates the radiative transfer in a highly magnetized plasma near the surface of a neutron star. The data are shown to indicate a field of about 10 to the 13th power G near the magnetic poles and the stopping of accreting matter by nuclear collisions in the neighboring plasma. Author

N76-11933* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OSO-8 OBSERVATIONS OF HERCULES X-1

S. H. Pravdo, R. H. Becker, E. A. Boldt, S. S. Holt, R. E. Rothschild, P. J. Serlemitsos, and J. H. Swank *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 21-33 refs (For availability see N76-11931 02-89)
CSCL 03A

The X-ray binary Her X-1 was observed by the GSFC cosmic X-ray detectors aboard OSO-8 between August 26 and September 3, 1975. The data indicate that Her X-1 turned on in its approximately 35-day cycle by 10h UT August 28. The results reported here are based on quick look tapes which contain less than 10% of the total time spent on source. Spectra were observed during different phases of the binary period including the anomalous low state (dip) in X-ray intensity. The normal high spectra is well represented by a power law with a short cutoff above approximately 25 keV. A significant and varying enhancement in the intensity around 6.7 keV is observed, suggesting the presence of an iron line. Absorption is seen in the spectrum immediately following eclipse. The dip spectrum is found to be considerably flattened. Also spectra are presented for different phases of the pulse period. Author

N76-11934* Tubingen Univ. (West Germany). Astronomisches Inst.

CENTAURUS X-3: THE OBSERVATIONAL PICTURE

Horst Mauder *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 39-43 refs (For availability see N76-11931 02-89)
CSCL 03A

X-ray observations of the neutron star Cen X-3 by various astronomers are briefly reviewed including optical light curves and X-ray pulsations. F.O.S.

N76-11935* Tubingen Univ. (West Germany). Astronomisches Inst.

THE INTERPRETATION OF OPTICAL LIGHT VARIATIONS OF CENTAURUS X-3

Horst Mauder *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 45-53 refs (For availability see N76-11931 02-89)
CSCL 03A

The duration of the X-ray eclipse and the amplitude of light variations are discussed in terms of mass ratio for the components of binary stars such as Cen X-3. F.O.S.

N76-11936* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE INTERSTELLAR MATTER COLUMN DENSITY TO CEN X-3

C. Ryter *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 57-64 refs (For availability see N76-11931 02-89)
CSCL 03A

Cen X-3 is associated with an OB supergiant, and yields of 8.8 x 10 to the 21st power H atoms/sq cm were obtained. The effect of such a column density is easily detectable in the X-ray range. The spectrum exhibits a low energy cut-off, which, according to the usual practice, is parametrized by a column of cold matter, N sub X. The cut-off is definitely observed to be variable and values of N sub X range from approximately 0 to 1.5 x 10 to the 23rd power H atoms/sq cm. There is a suggestion that sometimes N sub X < N sub H. It is concluded that on those occasions a spurious soft X-ray component is present in the source, bearing close similarity with Cyg X-1. When N sub X is large, self-absorption in an optically thick gas is very likely to take place. Author

N76-11937* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OSO-8 GSFC RESULTS ON CEN X-3

J. H. Swank, R. H. Becker, E. A. Boldt, S. S. Holt, S. H. Pravdo, R. E. Rothschild, and P. J. Serlemitsos *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 67-79 refs (For availability see N76-11931 02-89)
CSCL 03A

Spectra of Cen X-3 during eclipse, in transition out of eclipse, and during several later phases of the binary orbit were obtained from quick look data of the July 16-25, 1975 observation by the Goddard X-ray spectroscopy experiment on OSO-8. In the high state there was no absorption turn over. Pulsations were present at least to 23 keV. The spectrum at the pulse minimum was flatter above 7 keV than that of the pulse peak. In transition out of eclipse Cen X-3 emerged above a small low energy flux seen during eclipse. The observations appear to indicate absorption by cold and ionized matter and the presence of iron in the companion's atmosphere. Decreased intensities were observed at late phases of some binary orbits in some cases corresponding to dips. Absorption appears although the low energy component remains. Variable features may be interpretable as absorption and emission by iron and possibly other trace elements. Author

N76-11938* University Coll., London (England). Mullard Space Science Lab.

PULSED X-RAY OBSERVATIONS OF CEN X-3 FROM ARIEL-5

I. R. Tuohy *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 81-94 refs (For availability see N76-11931 02-89)
CSCL 03A

The 4.8 second X-ray pulsations from Centaurus X-3 were monitored by the MSSL collimated proportional counter on board Ariel-5 between 18-27 January, 1975. Analysis of the source Doppler effect shows that the pulsation period of Cen X-3 decreased by 3.70 + or - 0.04 milli-seconds during the preceding 2.3 years. The Doppler analysis also yields updated values for the binary phase and period of Cen X-3. Phase zero occurred at JD 2442438.628 + or - 0.003 and the heliocentric binary period between October, 1972, and January, 1975, was 2.087129 + or - 0.000007 days. Light curves of the 4.8 second pulsations in the 3-9 keV band are presented and are contrasted with previous Uhuru measurements. Author

N76-11939* Tubingen Univ. (West Germany). Astronomisches Inst.

THE 4.8 H VARIATION OF CYGNUS X-3 AT HIGH X-RAY ENERGIES

W. Pietsch, E. Kendziorra, R. Staubert, and J. Truemper *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 99-109 refs Submitted for publication (For availability see N76-11931 02-89)

CSCL 03A

During a balloon observation of Cygnus X-3 on February 20, 1975 an intensity variation was found which is in phase with the low energy X-ray 4.8 hour sinusoidal light curve. The measured relative amplitude in the energy range 29 - 70 keV is 0.37 + 0.31 to - 0.29. Compared with the results at lower energies there is no indication for an energy dependence of the relative amplitude up to 70 keV. The encountered low intensity source spectrum is compared with previous measurements. Author

N76-11940* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EARLY LIGHT CURVE OF A0620-00

L. J. Kaluzienski (Maryland Univ., College Park), S. S. Holt, E. A. Boldt, and P. J. Serlemitsos *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 111-117 (For availability see N76-11931 02-89)

CSCL 03A

The measurements of the 3-6 keV X-ray intensity of 0620-00 by the Ariel-5 All-Sky Monitor are discussed along with the light curves and source duration. F.O.S.

N76-11941* Massachusetts Inst. of Tech., Cambridge.

OBSERVATIONS OF A0620-00 BY SAS-3

H. Bradt and T. Matilsky *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 119-127 (For availability see N76-11931 02-89)

CSCL 03A

Beginning August 8, 1975 the transient X-ray source A0620-00 was observed using the SAS-3 X-ray observatory. At maximum X-ray luminosity, approximately Aug. 13, and thereafter, limits of less than approximately 2% were placed on periodic variations from 0.2 ms - 2000 sec. On Aug. 27, the low energy (0.15-0.9 keV) system was pointed at the source, and a spectrum derived of kT approximately 1.3 keV and F = 0.000001 erg/sq cm sec (0.3-10 keV) with N sub H = 3.9 + or - 0.3 x 10 to the 21st power/sq cm. Hardness ratios are presented, as well as detailed light curves, from Aug. 8 to Oct. 14. Of particular interest is a dramatic initial softening of the source on Aug. 8, a gradual hardening from Aug. 9 - Aug. 14, and a softening from Aug. 20 - Sept. 17. Author

N76-11942* Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.

OPTICAL IDENTIFICATION OF A0620-00

R. Wolfson and F. Boley *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 129-142 refs (For availability see N76-11931 02-89)

CSCL 03A

Identification of the optical counterpart to the transient X-ray source A0620-00 was made on 16 August, 1975, using image tube photography at the McGraw-Hill Observatory on Kitt Peak, Arizona. Spectra taken subsequent to the identification showed no stellar absorption or emission features. Photometric data gave a V magnitude of 11.2 + or - .1. This is about 8 magnitudes brighter than the object appears on the Palomar Sky Survey. Author

N76-11943* Yale Univ., New Haven, Conn. Dept. of Physics.

FORMATION OF HARD X-RAY TAILS

Douglas M. Eardley *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 157-168 refs (For availability see N76-11931 02-89)

(Grant NSF GP-36317)

CSCL 03A

X-ray observations of Cygnus X-1 showed a power-law spectrum. A natural way that this spectrum might arise is discussed. Inverse Compton scattering of a soft photon flux in a very hot accretion disk, kT sub e approximately 100 keV. The slope of the spectrum may vary if source conditions vary. Author

N76-11944* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NEW RESULTS FROM LONG-TERM OBSERVATIONS OF CYG X-1

S. S. Holt, E. A. Boldt, P. J. Serlemitsos, and L. J. Kaluzienski (Maryland Univ., College Park) *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 169-184 refs Submitted for publication (For availability see N76-11931 02-89)

CSCL 03A

Observations of Cyg X-1 between October 1974 and July 1975 reveal a persistent 5.6 day modulation of the 3-6 keV X-ray intensity, having a minimum in phase with superior conjunction of the HDE 226868 binary system. The modulation is found to be most pronounced just prior to the April-May 1975 increase of Cyg X-1, after which both the modulation and intensity are at their lowest values for the entire duration of the observations. These data imply that the X-ray emission from Cyg X-1 arises from the compact member of HDE 226868, and that the increase of April-May 1975 represented the depletion of accreting material which had not yet been mixed into a cylindrically symmetric accretion disk about the compact member. Author

N76-11945* California Univ., La Jolla. Dept. of Physics.

INTENSITY AND SPECTRAL VARIATIONS OF CYG X-1 OBSERVED FROM BALLOONS

J. L. Matteson, R. F. Mushotzky, W. S. Paciesas, and J. G. Laros (LASL) *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 185-203 refs (For availability see N76-11931 02-89)

CSCL 03A

Observations of Cyg X-1 with a 20 to 200 keV balloon carried X-ray telescope in 1969, 1970, and 1972 are presented. These results reveal the following characteristics of Cyg X-1: The steep spectrum observed at E < 10 keV during the radio quiet phase can extend to 200 keV. This phase may have lasted 21 months (July 1969 to March 1971). The flux at 30 keV can vary from 0.011 to 0.0014 ph/sq cm/sec/keV and that at 100 keV from 0.0014 to 0.0001. The low flux values are factors of 3 and 8 below the normal values at 30 and 100 keV respectively, are rarely observed, and may be associated with the early phase of the 1971 April X-ray transition. During some one hour periods the intensity remained constant to approximately 20% and during other periods it varied a factor 2 in 5 minutes and a factor 10 in 1 hour. Complex spectral variations accompanied the intensity changes. Author

N76-11946* Royal Greenwich Observatory, Hailsham (England).

ABSORPTION DIPS AT LOW X-RAY ENERGIES IN CYGNUS X-1

Paul Murdin *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 205-207 refs (For availability see N76-11931 02-89)

CSCL 03A

The three more looks with the Copernicus satellite at Cygnus X-1 have produced four more examples of absorption dips - decreases in the 2 to 7 keV flux from Cygnus X-1 with an increase of spectral hardness consistent with photoelectric absorption. The nine now seen, including one by OSO-7 are listed. Their phase in the spectroscopic binary HD 226868 is also listed, calculated from a newer ephemeris than that in Mason et al (1974), adding the radial velocities by Bolton (1975) and unpublished RGO radial velocities from the 1975 season. These elements do not differ significantly from Bolton's (1975). Author

N76-11947* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HIGH RESOLUTION MEASUREMENTS OF CYG X-1 FROM ROCKETS

R. E. Rothschild, E. A. Boldt, S. S. Holt, and P. J. Serlemitsos *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 209-218 (For availability see N76-11931 02-89)

CSCL 03A

Cyg X-1 was observed on two occasions (Oct. 4, 1973 and

Oct. 3, 1974) by the Goddard X-ray rocket payload. This payload consisted of two gas proportional counters (xenon-methane with 710 sq cm and argon-methane with 610 sq cm) using the same 128 channel pulse height analyzer and having 320 microsecond temporal resolution on the 1973 flight and 160 microsecond resolution on the 1974 flight. During both flights bursts of 1 ms duration were observed with very high statistical certainty. To date all 13 of these bursts were analyzed for spectral and temporal character, and the results of this analysis are presented. The spectra of overall X-ray emission from both flights are also presented. Author

N76-11948* Toronto Univ. (Ontario). David Dunlap Observatory.
OPTICAL OBSERVATIONS OF HDE226868 EQUALS CYGNUS X-1: A REVIEW
C. T. Bolton *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 219-243 refs (For availability see N76-11931 02-89)
CSCL 03A

The present knowledge of the binary system HDE226868 (Cygnus X-1) is summarized, and some correctible deficiencies in the optical observations are presented. The dimensions of the system, nature of the X-ray sources, and properties of the mass transfer are discussed. Author

N76-11949* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE EFFECTS OF RADIATION PRESSURE ON THE EQUIPOTENTIAL SURFACES IN X-RAY BINARIES
Yoji Kondo and G. E. McCluskey (Lehigh Univ.) *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 245-255 (For availability see N76-11931 02-89)
CSCL 03A

Equipotential surfaces, which incorporate the effects of radiation pressure, were computed for X-ray binaries Cen X-3, Cyg X-1, 3U0900-40 and 3U1700-37. The radiation pressure affects the equipotential surfaces seriously enough that the so-called critical Roche (Jacobian) lobes, or the traditional figure 8s, disappear. The effects of these results on modeling X-ray binaries are discussed. Author

N76-11950* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE SKYLAB S019 ULTRAVIOLET SPECTRA OF HD153919 (EQUALS 3U1700-37) AND HDE226868 (EQUALS CYG X-1)
Yoji Kondo, S. B. Parsons (Tex. Univ., Austin), K. G. Henize, J. D. Wray (Tex. Univ., Austin), and G. F. Benedict (Tex. Univ., Austin) *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 277-279 (For availability see N76-11931 02-89)
CSCL 03A

Ultraviolet spectra of HD153919 (3U1700-37) and HDE226868 (Cyg X-1) were obtained with the S019 Ultraviolet Objective Prism Spectrograph carried onboard Skylab. The observations for HD153919 were obtained at 01h58m and 02h02m 23 August and 22h08m and 22h13m 1 September 1973 (U.T.), and at 19h27m 14 September 1973 (U.T.) for HDE226868 during the second manned mission of Skylab. The ultraviolet spectrum of HD153919 did not change materially between the observations made at those two dates. The spectrum being discussed is the unwidened spectrum obtained in a 4.5 minute exposure at 22h08m 1 September 1975, which reached the shortest wavelength of about 1600 A. It resembles other O-type stars observed with the S019 camera except that HD153919 shows the N IV line at 1718 A in P-Cygni type emission. The same line is seen in emission only in W-R stars observed with the S019 spectrograph. The time of observation coincided with the time of X-ray eclipse, which was due at about 21h50m 1 September 1975. The relative spectral energy distribution of HD153919 is that of a reddened O-type star. Author

N76-11951* Center for Astrophysics, Cambridge, Mass.
THE X-RAY BINARY HD77581 PLUS 3U 0900-40
N. V. Vidal *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 281-331 refs (For availability see N76-11931 02-89)
CSCL 03A

The properties of the binary systems in the different regions of the electromagnetic spectrum are presented. X-ray observations, optical light curves, radial velocity curves, and the distribution of circumstellar material form H alpha studies are discussed. F.O.S.

N76-11952* Amsterdam Univ. (Netherlands).
MASS DETERMINATION FOR THE X-RAY BINARY SYSTEM VELA X-1 (EQUALS 3U 0900-40)
J. A. VanParadijs, G. Hammerschlag-Hensberge, E. P. J. VandenHeuvel, R. J. Takens, E. J. Zuiderwijk, and C. DeLoore (Vrije Univ., Brussels) *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 337-352 refs (For availability see N76-11931 02-89)
CSCL 03A

From a radial velocity study of lines of He I and the heavier ions of HD 77581 (Vela X-1), the orbital elements for the X-ray binary system are derived. Together with the orbital elements given by Rappaport and McClintock from X-ray Pulsar results, this enables the determination of masses for both the X-ray and the early type supergiant component: M sub x = 1.61 + or - 0.22 solar mass and M sub opt = 21.2 + or - 2.4 solar mass, respectively. Author

N76-11953* Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE OTHER GALACTIC X-RAY SOURCES
Herbert Gursky *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 353-361 refs (For availability see N76-11931 02-89)
CSCL 03A

The results of studying strong X-ray sources with identified optical companions are reviewed. The characteristics of the nine identified binary systems are summarized. The models for these systems are discussed along with luminosity sources, globular cluster sources, and transient sources. F.O.S.

N76-11954* California Univ., Berkeley. Space Sciences Lab.
SIMULTANEOUS X-RAY AND OPTICAL OBSERVATIONS OF X PERSEI
Bruce Margon *In* NASA. Goddard Space Flight Center Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 373-383 refs (For availability see N76-11931 02-89)
CSCL 03A

Photoelectric photometry of X Persei was obtained on five out of seven consecutive nights in January 1975, from the Lick and Leuschner Observatories. The observations yield B = 6.848 + or - 0.002, B-V = 0.139 + or - 0.001, with no strong evidence for variability during the observing run. These are the faintest and bluest photoelectric magnitudes and colors ever reported for X Per; this change apparently occured relatively uniformly during 1973-74 and is reminiscent of behavior last observed in approximately 1900. The suggested association of X Persei with the weak X-ray source 3U 0352+30 raises the possibility of detection of X-ray/optical covariability. A simultaneous optical/X-ray observation was conducted utilizing ground-based photometry and a satellite-borne proportional counter. On 1975 January 21, 7 hours of data were obtained from both observatories simultaneous with OAO Copernicus X-ray observations of 3U 0352+30. The X-ray data varied during this period by a factor of two, but there is no obviously correspondent optical activity, to a level of 0.02 mag. The optical data are also used to limit to 0.01 mag variations coincident with the X-ray periodicity reported by White et al. Author

N76-11955* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OSO-8 OBSERVING SCHEDULE FOR X-RAY BINARIES
Roger J. Thomas *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 385-391 (For availability see N76-11931 02-89)
CSCL 03A

Six different instruments on OSO-8 observed several binary X-ray sources between energies of 0.13 keV and 1 MeV at various times since 21 June 1975. The schedule for these observations is given, as well as the present plan for such future

observations through July 1976. The OSO-8 observing schedule for the transient X-ray source A0620-00 is included. Author

N76-11956* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF THE COSMIC SOURCES OF HARD X-RAYS
B. R. Dennis, J. Beall (Maryland Univ., College Park), C. J. Crannell, K. J. Frost, and L. E. Orwig *In its* Workshop Papers for a Symp. on X-ray Binaries Oct. 1975 p 395-402 refs (For availability see N76-11931 02-89)
CSCL 03A

An actively-shielded, high-energy X-ray telescope was launched onboard OSO-8 on 21 June 1975. The primary objectives of this experiment are the measurements of the energy spectrum of discrete cosmic X-ray sources in the range 20 keV to 3 MeV, and the temporal variations in the intensity of each source detected with a time resolution of 0.3 msec. From 16 July through 18 July 1975 the X-ray binary, Cen X-3, was observed with the hard X-ray telescope. For this source, complete data coverage is needed before statistically significant results can be reported on the high-energy X-ray spectrum and the energy dependence of the pulsed fraction. With the partial data coverage presently available, statistically significant results were obtained from observations of Cen A (27 July through 4 August 1975) and Sco X-1 (6 through 9 September 1975). Some of the hard X-ray sources which will be the observational objectives of this experiment during the period from October 1975 through June 1976 are Cyg X-1, Cyg X-2, Per X-1, Tau X-1, Vel X-1, Com X-1, Vir X-1, and 3C273. Author

N76-11957*# Aerospace Corp., El Segundo, Calif. Electronics Research Lab. and Space Physics Lab.
ASTRONOMY RESEARCH AT THE AEROSPACE CORPORATION Interim Report
George A. Paulikas 17 Dec. 1974 32 p
(Contracts NASw-2361; NAS8-29602; F04701-74-C-0075)
(NASA-CR-145579; AD-A004069; SAMSO-TR-74-265; TR-0075(9260-02)-4) Avail: NTIS HC $3.75 CSCL 03/2

This report reviews the astronomy research carried out at The Aerospace Corporation during 1974. The report describes the activities of the San Fernando Observatory, the research in millimeter wave radio astronomy as well as the space astronomy research. GRA

N76-11958# European Space Agency, Paris (France).
X-RAY ASTRONOMY AND RELATED TOPICS
R. D. Andresen, comp. (ESRTC, Noordwijk, Neth.) May 1975 218 p refs Proc. of an ESA Colloq., Noordwijk, Neth., 25-26 Feb. 1975
(ESA-SP-110-Preprint) Avail: NTIS HC $7.75

The colloquium concerning the mission of the European X-ray Observatory Satellite (EXOSAT) to be launched in 1979 is reported. This satellite will carry instrumentation to measure cosmic X-rays from below 1 keV to above 20 keV. The principal objectives are to measure the location of X-ray sources with a precision of one arc second, using lunar occultation technique, and to study the temporal behavior and the energy spectra of sources for long uninterrupted periods. The papers presented cover previous results from satellite observations, details of the onboard experiments, and possible applications of the occultation technique. For individual titles, see N76-11959 through N76-11976.

N76-11959 University Coll., London (England). Mullard Space Science Lab.
GALACTIC X-RAY SOURCES
J. L. Culhane *In* ESA X-Ray Astronomy and Related Topics May 1975 p 3-23 refs (For availability see N76-11958 02-89)

Categories of galactic X-ray sources taken from the Uhuru catalog are discussed. The Uhuru sources are classified by galactic latitude into galactic and extra galactic populations. The galactic sources include a group of highly luminous objects near the galactic center, the compact X-ray sources in binary systems, and the X-ray emitting supernova remnants. Galactic center sources are briefly dicussed and compact object binary sources are examined in detail. The supernova remnants are considered, and brief remarks are made about sources in globular clusters and transient X-ray sources. ESA

N76-11960 University Coll., London (England). Mullard Space Science Lab.
THE ARIEL 5 AND UK 6 SATELLITES
P. W. Sanford *In* ESA X-ray Astronomy and Related Topics May 1975 p 25-51 (For availability see N76-11958 02-89)

Onboard experiments are described for the Ariel 5 and UK-6 satellites related to their galactic X-ray sources missions. For the Ariel 5 satellite (launched October 15, 1974), four of the experiments view either along or close to the spin axis. The other two are scanning experiments, one with wide angle view centered perpendicular to the spin axis. The experiments determine positions of X-ray sources, survey new X-ray stars, observe polarization, spectra and temporal variability of X-ray sources, and continuous monitoring of the whole celestial sphere. The UK-6 satellite, to be launched in 1977, provides a platform for measurements in the 0.1 to 2 keV range low energy X-ray sources. ESA

N76-11961 Astronomical Inst., Utrecht (Netherlanos).
THE ASTRONOMICAL NETHERLAND SATELLITE (ANS)
A. C. Brinkmann *In* ESA X-ray Astronomy and Related Topics May 1975 p 53-60 (For availability see N76-11958 02-89)

Onboard instrumentation and some of the results for the measurement of X-ray sources are described. The X-ray instruments consist of an X-ray spectrometer set to observe Si-lines, two proportional counters for 1 to 20 keV and 0.3 to 8 keV, respectively, and a collecting mirror 0.2 to 0.3 keV. Results are described covering known X-ray sources and possible soft X-ray sources. ESA

N76-11962 Massachusetts Inst. of Tech., Cambridge.
THE SAS-C X-RAY OBSERVATORY
J. E. McClintock *In* ESA X-ray Astronomy and Related Topics May 1975 p 61-67 (For availability see N76-11958 02-89)

A short description is given of the SAS-C X-ray observatory (small astronomical satellite), and its onboard instruments. ESA

N76-11963 European Space Research and Technology Center, Noordwijk (Netherlands).
AN INTRODUCTION TO THE EXOSAT MISSION
B. G. Taylor *In* ESA X-Ray Astronomy and Related Topics May 1975 p 69-74 (For availability see N76-11958 02-89)

The mission of the satellite for X-ray astronomy is briefly described. The objectives are the measurement of position, structural features, and spectral and temporal characteristics of cosmic X-ray sources in the energy range from less than 1 keV to greater than 20 MeV. Lunar occultation will be used for determining position and diameter of the sources, but most of its lifetime the satellite will be in an arbitrary pointing mode for viewing the whole of the celestial sphere. Some details of the attitude control system are mentioned. ESA

N76-11964 Leicester Univ. (England). Dept. of Physics.
THE MEDIUM ENERGY EXPERIMENT FOR EXOSAT
Jeffrey A. Hoffman *In* ESA X-Ray Astronomy and Related Topics May 1975 p 75-87 (For availability see N76-11958 02-89)

A description is given of the medium energy (1-50 keV) proportional detectors and collimator. The requirements of this system are (1) overlap with low energy system, (2) high time resolution, (3) spectral studies, and (4) weak source observation. A summary is given of the medium energy instrument consisting of the large area, double layer proportional counters, and the collimator. Background and noise estimates for the experiment are given as well as a performance and a sensitivity prediction. ESA

N76-11965 Leiden Univ. (Netherlands). Cosmic-Ray-Working Group.
THE LOW-ENERGY EXPERIMENT ON EXOSAT
J. A. M. Bleeker *In* ESA X-Ray Astronomy and Related Topics May 1975 p 89-108 ref (For availability see N76-11958 02-89)

Major characteristics of the low energy X-ray instrumentation and its expected scientific return are discussed for EXOSAT. The experiment subsystems of the baseline are: the X-ray collector, which consists of a nested set of parabolic concentrators; focal plane detectors; and filters. Since a major portion of the EXOSAT

observing time will be spent in arbitrary pointing mode, the return from the mission can be optimized by an X-ray imaging telescope. Details of this option are provided. ESA

N76-11966 Leiden Univ. (Netherlands). Cosmic Ray Working Group.
LOW ENERGY SPECTROSCOPY WITH EXOSAT
J. A. M. Bleeker *In* ESA X-ray Astronomy and Related Topics May 1975 p 109-117 refs (For availability see N76-11958 02-89)

The scientific return expected from the EXOSAT low energy broadband spectrometer, and the optimal imaging telescope grating spectrometer are discussed. The X-ray sources which could be investigated are: point sources, extended sources (supernova remnants and extragalactic clusters), and the interstellar medium. ESA

N76-11967 Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
LUNAR OCCULTATION OF POINT X-RAY SOURCES
C. Reppin *In* ESA X-ray Astronomy and Related Topics May 1975 p 119-127 (For availability see N76-11958 02-89)

The accuracy is discussed of localizing X-ray sources by means of lunar occultation techniques for the EXOSAT satellite. The achievable positional accuracy is indicated for medium and low energy experiments, and an indication is given of which sources can be occulted for a lifetime of one year. ESA

N76-11968 Royal Greenwich Observatory, Hailsham (England).
OPTICAL IDENTIFICATION OF X-RAY SOURCES
M. V. Penston *In* ESA X-ray Astronomy and Related Topics May 1975 p 129-131 refs (For availability see N76-11958 02-89)

The accuracy of optical X-ray source identification is discussed, and possible improvements produced by EXOSAT are considered. ESA

N76-11969 Observatoire de Paris-Meudon (France). Dept. de Radioastronomie.
IDENTIFICATION OF X-RAY SOURCES WITH RADIO OBJECTS
James Lequeux *In* ESA X-Ray Astronomy and Related Topics May 1975 p 133-137 (For availability see N76-11958 02-89)

An intercomparison of X-ray and radio structure of galactic and extragalactic sources is proposed, and the possible role of EXOSAT therein is discussed. This intercomparison would provide a large amount of information of astrophysical interest, e.g. on the emission processes, inverse Compton or other, and physical conditions in the source. ESA

N76-11970 Milan Univ. (Italy).
THE PRECISE LOCATION OF X-RAY SOURCES AND THEIR IDENTIFICATION WITH INFRA-RED OBJECTS
C. Occhialini-Dilworth *In* ESA X-Ray Astronomy and Related Topics May 1975 p 139-145 refs (For availability see N76-11958 02-89)

The types of relation between X-ray and infrared emission are outlined, and examples are given of the identification of X-ray sources and infrared objects. The possible uses of high precision in the location of the X-ray sources are analyzed for (1) the identification of the infrared counterpart of distant galactic sources, (2) search for peaks of X-ray emission in coincidence with peaks of infrared emission at the galactic center, (3) the location of the X-ray source with respect to the infrared peak in extragalactic sources, (4) search for infrared counterparts of the unidentified X-ray objects, and (5) identification and observation of the infrared counterpart of transient sources. ESA

N76-11971 Amsterdam Univ. (Netherlands). Inst. for Astronomy.
PULSATING AND BINARY X-RAY SOURCES
E. P. J. VanDenHeuvel *In* ESA X-Ray Astronomy and Related Topics May 1975 p 147-157 refs (For availability see N76-11958 02-89)

The possible discovery of new X-ray binary sources with EXOSAT and HEAO is discussed, as well as a further study of the accretion process. Accretion of matter onto a compact star (neutron star or black hole) is considered to be the cause of X-ray emission. ESA

N76-11972 Cambridge Univ. (England). Inst. of Astronomy.
SOURCE STRUCTURE VIA THE OCCULTATION TECHNIQUE
A. C. Fabian *In* ESA X-Ray Astronomy and Related Topics May 1975 p 159-165 refs (For availability see N76-11958 02-89)

Ultimate limitations on measurements of X-ray source structure are considered for the EXOSAT mission. A fundamental lower limit to flux measurements is derived from X-ray source counts available from the Uhuru satellite. Most sources observed have a sufficiently high surface brightness so that confusion will not prove a problem. Limits on the measuring methods of telescopes, modulation collimators, and occultation are mentioned. ESA

N76-11973 Commissariat a l'Energie Atomique, Saclay (France).
SPATIAL STRUCTURE IN GALACTIC X-RAY SOURCES
Sergio A. Ilovaisky *In* ESA X-Ray Astronomy and Related Topics May 1975 p 167-173 refs (For availability see N76-11958 02-89)

The necessity for high spatial resolution X-ray observations of supernova remnants is analyzed. Such observations would help to understand the nature of the energy production mechanisms in and behind the shock wave and perhaps help to distinguish between different models. ESA

N76-11974 Mullard Radio Astronomy Observatory, Cambridge (England). Cavendish Lab.
THE STRUCTURES OF EXTRAGALACTIC X-RAY SOURCES
M. S. Longair *In* ESA X-Ray Astronomy and Related Topics May 1975 p 175-191 refs (For availability see N76-11958 02-89)

The structure of extragalactic X-ray sources is considered from the viewpoint of radio astronomy and theoretical astrophysics for the EXOSAT mission. Radio and X-ray observations of extragalactic objects give complementary information about the physical conditions in these systems. High quality radio observations are therefore invaluable in interpreting the X-ray observations. In interpreting the results from an occultation satellite, the specific hypotheses concerning the origin of the X-ray emission should be tested. ESA

N76-11975 Tubingen Univ. (West Germany). Inst. fuer Astronomie.
X-RAY HALOS
H. Spiegelhauer and J. Truemper *In* ESA X-Ray Astronomy and Related Topics May 1975 p 193-202 refs (For availability see N76-11958 02-89)

The possibilities of observing interstellar grain from halo formations onboard the EXOSAT satellite are considered. The characteristics of halos and grain properties are outlined. It is shown that halo observations can be performed with the EXOSAT medium energy instrument in the occultation mode, and with the low energy instrument in both the occultation and arbitrary pointing mode. ESA

N76-11976 European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
PROPOSALS FOR THE EXOSAT OBSERVATION PROGRAMME AND CHOICE OF ORBIT
R. D. Andresen *In* ESA X-Ray Astronomy and Related Topics May 1975 p 203-214 (For availability see N76-11958 02-89)

A summary is presented of experiment proposals for EXOSAT and of occultable X-ray sources. The choice of the highly eccentric orbit is motivated by the number of occultation possibilities therein. ESA

N76-11977# European Southern Observatory, Hamburg (West Germany).
[ACTIVITIES OF THE EUROPEAN SOUTHERN OBSERVATORY] Annual Report, 1974
1975 57 p
Avail: NTIS HC $4.50

The construction of the main parts of the 3.6 meter telescope

and the building to house it is discussed. Small scale versions of an electronic control system were installed on 1 m and Schmidt telescopes. Unexplored portions of the southern sky were photographed. Research on galactic structure and interstellar matter, globular clusters, the Magellanic clouds, and external galaxies was carried out. Infrared and other photometric observations were performed. Special objects were followed up and comet Kohoutek was observed with spectrophotometric techniques. Joint programs were carried out with the Chilean University. A list of meetings and visiting scientists publications is given as well as the budget statement. ESA

N76-11925 Joint Publications Research Service, Arlington, Va.
EXOATMOSPHERIC ASTRONOMY
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 94-111 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 18 p (For availability see N76-11919 02-88)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

No abstracts in this category.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-11978*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPARATIVE STUDIES OF LUNAR, MARTIAN, AND MERCURIAN CRATERS AND PLAINS
V. R. Oberbeck, R. E. Arvidson (Washington Univ., St. Louis), and H. R. Aggarwal (Santa Clara Univ., Calif.) Sep. 1975 36 p refs Presented at Intern. Colloq. of Planetary Geol., Rome, 22-30 Sep. 1975
(NASA-TM-X-62501; A-6339) Avail: NTIS HC $4.00 CSCL 03B

The spatial distribution of lunar smooth plains is not consistent with experimental simulations of melt rock emplacement during cratering in layered materials. Nor is it consistent with the location of melt rocks (suevite) near the Ries basin. Lunar smooth plains surrounding Imbrium are most extensive in areas where pre-existing craters are most degraded. This observation suggests that plains form by impact of basin and local primary crater ejecta, together with deposition of debris excavated by the resultant secondary cratering events. Craters within the belt of smooth plains surrounding the Caloris basin on Mercury are most degraded nearest the basin; this suggests that Mercurian smooth plains must, at least in part, be emplaced in a manner similar to plains surrounding the Imbrium basin. Mercurian uplands have a primary crater population deficient in small crater diameters (less than approximately 30 km). Lunar uplands far from major basins also have a crater population deficient in small crater sizes. Martian cratered terrain exhibits a similar crater deficiency, which was previously interpreted as due to obliteration of small craters (less than approximately 30 km) by some surface process. A crater size distribution deficient in small sizes (less than approximately 30 km) on the Mercurian, lunar, and Martian uplands has implications for the origin of debris bombarding the inner solar system during the period recorded by these surfaces. It is proposed that during late heavy bombardment, the inner solar system was inundated with bodies that broke up under tidal fission as they approached the planets. Such a mechanism would lend to production of a crater population deficient in small crater sizes, and it would also explain the large degree of spatial clustering of primary craters on Mercury, the moon, and Mars. Author

N76-11979*# Joint Publications Research Service, Arlington, Va.
WEATHER AND CLIMATE ON THE PLANETS
K. Ya. Kondratyev Washington NASA Nov. 1975 53 p refs Transl. into ENGLISH from Novoye v Zhizni, Nauke, Tekhnike. Seriya Kosmonavtika, Astronomiya (Moscow), no. 8, 1975 p 1-64 Sponsored by NASA
(NASA-TT-F-16589) Avail: NTIS HC $4.50 CSCL 03B

Automatic interplanetary station observations and theoretical investigations of weather conditions and climate on Venus, Mars and Jupiter are discussed, which are opening up good prospects for the development of the comparative meteorology of the planets. Author

N76-11980*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
THE APOLLO LUNAR SURFACE EXPERIMENT PACKAGE SUPRATHERMAL ION DETECTOR EXPERIMENT Final Report
Jul. 1975 240 p refs
(Contract NAS9-5911)
(NASA-CR-144544) Avail: NTIS HC $8.00 CSCL 03B

A compilation of reports and scientific papers is presented for the following topics: (1) the lunar ionosphere; (2) electric potential of the lunar surface; (3) ion activity on the lunar nightside; (4) bow shock protons; (5) magnetosheath and magnetotail; (6) solar wind-neutral gas cloud interactions at the lunar surface; (7) penetrating solar particles; and (8) rocket exhaust products from Apollo missions. Descriptions and photographs of ion detecting equipment at the lunar sites of Apollo 12, 13, 14, and 15 are given. J.R.T.

N76-11981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUMMARY OF INITIAL RESULTS FROM THE GSFC FLUXGATE MAGNETOMETER ON PIONEER 11
Mario H. Acuna and N. F. Ness Oct. 1975 34 p refs Presented at Tucson Jupiter Meeting, 18-23 May 1975 Revised
(NASA-TM-X-70899; X-690-75-125-Rev) Avail: NTIS HC $4.00 CSCL 03B

The main magnetic field of Jupiter was measured by the Fluxgate Magnetometer on Pioneer 11 and analysis reveals it to be relatively more complex than expected. In a centered spherical harmonic representation with a maximum order of n = 3 (designated GSFC model 04), the dipole term (with opposite polarity to the Earth's) has a moment of 4.28 Gauss x (Jupiter radius cubed), tilted by 9.6 deg towards a system 111 longitude of 232. The quadrupole and octupole moments are significant, 24% and 21% of the dipole moment respectively, and this leads to deviations of the planetary magnetic field from a simple offset tilted dipole for distances smaller than three Jupiter radii. The GSFC model shows a north polar field strength of 14 Gauss and a south polar field strength of 10.4 Gauss. Enhanced absorption effects in the radiation belts may be predicted as a result of field distortion. Author

N76-11982*# California Univ., Berkeley. Space Sciences Lab.
MARTIAN SURFACE WEATHERING STUDIES Final Report, 1 Jan. 1972 - 30 Jun. 1973
Melvin Calvin 30 Jun. 1973 18 p refs
(Grant NGR-05-003-302)
(NASA-CR-145611; SSL-Ser-16-Issue-64) Avail: NTIS HC $3.50 CSCL 03B

The nature of the Martian surface was characterized by means of its reflectance properties. The Mariner 9 photography was used to establish terrain units which were crossed by the Mariner 6 and 7 paths. The IR reflectance measured by the IR spectrometers on these spacecraft was to be used to indicate the nature of the surface within these units. There is an indication of physical size and/or compositional variation between units but too many

natural parameters can vary (size, shape, composition, adsorbed phases, reradiation, atmospheric absorbtion, temperature gradients, etc.) to be certain what effect is causing those variations observed. It is suggested that the characterization could be fruitfully pursued by a group which was dedicated to peeling back the layers of minutia affecting IR reflectance. Author

N76-11983*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
THE 10 SHEATH-ACCELERATED ELECTRONS AND IONS
Stanley Shawhan Oct. 1975 31 p refs Presented at Workshop on Jupiter, Tucson, Ariz., 18-23 May 1975 Submitted for publication
(Grants NGL-16-001-002; NGL-16-001-043; NSF GA-31676) (NASA-CR-145612; U-of-Iowa-75-35) Avail: NTIS HC $4.00 CSCL 03B

A model is presented that suggests that plasma sheaths form between the ionospheric plasma moving with Io and the ambient plasma corotating with Jupiter. Potentials across these sheaths could be as high as 580 kV which is the motional emf across Io's ionosphere. Electrons and ions can be accelerated across these sheaths. The sheaths may exist at the top of the Io ionosphere with characteristic thicknesses of 1/4 kilometers. The model is consistent with the Pioneer observations of > 0.15 MeV electrons at the inner edge of Io's L-shell and the enhanced number density of low-energy protons at the outer edge. Ion sputtering of the Io surface is discussed and may explain the presence of atomic hydrogen and sodium in the vicinity of Io. Also these accelerated particles may be important to the formation of the Io ionosphere. High electron flux which may lead to decametric radio emissions, Jovian atmospheric heating and optical and X-ray emissions is also discussed.
Author

N76-11984*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
A NUMERICAL CIRCULATION MODEL WITH TOPOGRAPHY FOR THE MARTIAN SOUTHERN HEMISPHERE
Clifford Mass and Carl Sagan Oct. 1975 39 p refs
(Grant NGR-33-010-220)
(NASA-CR-145630; CRSR-611) Avail: NTIS HC $4.00 CSCL 03B

A quasi-geostrophic numerical model, including friction, radiation, and the observed planetary topography, is applied to the general circulation of the Martian atmosphere in the Southern Hemisphere at latitudes south of about 35 deg. Near equilibrium weather systems developed after about 5 model days. To avoid violating the quasi-geostrophic approximation, only 0.8 of the already smoothed relief was employed. Weather systems and velocity fields are strikingly tied to topography. A 2mb middle latitude jet stream is found of remarkably terrestrial aspect. Highest surface velocities, both horizontal and vertical, are predicted in western Hellas Planitia and eastern Argyre Planitia, which are observed to be preferred sites of origin of major Martian dust storms. Mean horizontal velocities and vertical velocities are found just above the surface velocity boundary layer. Author

N76-11920 Joint Publications Research Service, Arlington, Va.
INVESTIGATIONS OF THE MOON AND PLANETS
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 2-31 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 30 p (For availability see N76-11919 02-88)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-11985*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
QUANTITATIVE COMPARISONS OF TYPE 3 RADIO BURST INTENSITY AND FAST ELECTRON FLUX AT 1 AU
R. J. Fitzenreiter, L. G. Evans (Computer Sci. Corp., Silver Spring, Md.), and R. P. Lin (Calif. Univ., Berkeley) Sep. 1975 19 p refs Submitted for publication
(NASA-TM-X-71008; X-693-75-236) Avail: NTIS HC $3.50 CSCL 03B

The flux of fast solar electrons and the intensity of the type 111 radio emission generated by these particles were compared at one AU. Two regimes were found in the generation of type 111 radiation: one where the radio intensity is linearly proportional to the electron flux, and another, which occurs above a threshold electron flux, where the radio intensity is approximately proportional to the 2.4 power of the electron flux. This threshold appears to reflect a transition to a different emission mechanism. Author

N76-11986*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIRECTIVITY OF LOW FREQUENCY SOLAR TYPE 3 RADIO BURSTS
R. J. Fitzenreiter, J. Fainberg, and R. B. Bundy (Maryland Univ., College Park) Oct. 1975 20 p refs
(NASA-TM-X-71014; X-693-75-284) Avail: NTIS HC $3.50 CSCL 03B

The occurrence rate of type 3 solar bursts in the frequency range 4.9 MHz to 30 kHz was analyzed as a function of burst intensity and burst arrival direction. Results show that: (1) the occurrence rate of bursts falls off with increasing flux and (2) the distribution of burst arrival directions at each frequency shows a significantly larger number of bursts observed west of the earth-sun line than east of it. This western excess in occurrence rate appears to be correlated with the direction of the average interplanetary magnetic field, and is interpreted as beaming of the observed burst radiation along the magnetic field direction.
Author

N76-11987# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A SIMPLE MODEL FOR SOLAR WIND FLOW
R. Smith Apr. 1975 9 p refs
(MATHS-Res-62) Avail: NTIS HC $3.50

A simple analytic method based on the constant-density approximation for hypersonic flow was used to calculate the magnetic field between the earth's bow shock and the magnetopause. The method has the advantage of illustrating a number of points that a numerical solution masks. In particular, for an infinitely-conducting fluid, the magnetic field becomes infinite on the magnetopause. Denoting the angle between the magnetic and velocity field ahead of the shock by alpha, the magnetic field for alpha = 0 (aligned flow) is not represented near the magnetopause by the limit alpha approaching zero. ESA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-11988*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
LOW ENERGY PARTICLE COMPOSITION
George Gloeckler 30 Sep. 1975 22 p refs Presented at the 14th Intern. Cosmic Ray Conf., Muenchen, West Germany, 27 Aug. 1975
(Contract NAS5-11063; Grants NGR-21-002-224; NGR-21-002-316)
(NASA-CR-145641; TR-76-055; Phys-Publ-76-080) Avail: NTIS HC $3.50 CSCL 03B

The energy spectra and composition of the steady or 'quiet-time' particle flux, whose origin is unknown was studied. Particles and photons which are associated with solar flares or active regions on the sun were also studied. Various detection techniques used to measure the composition and energy spectra of low energy particles are discussed. Graphs of elemental abundance and energy spectra are given. Author

N76-11989# Loughborough Univ. of Technology (England). Dept. of Mathematics
INTERACTING ELECTROMAGNETIC WAVES IN GENERAL RELATIVITY
J. B. Griffiths Mar. 1975 25 p refs
(MATHS-Res-58) Avail: NTIS HC $3.50

The problem is considered of finding exact solutions of the Einstein-Maxwell equations which describe the physical situation of two colliding and subsequently interacting electromagnetic waves. The general theory of relativity predicts a nonlinear interaction between electromagnetic waves. The situation is described using an approximate geometrical method, and a new exact solution describing two interacting electromagnetic waves is given. This describes waves emitted from two sources mutually focusing each other on the opposite source. Author (ESA)

N76-11990# Loughborough Univ. of Technology (England). Dept. of Mathematics.
COLLIDING GRAVITATIONAL AND ELECTROMAGNETIC WAVES
J. B. Griffiths Jul. 1975 6 p refs
(MATHS-Res-70) Avail: NTIS HC $3.50

An exact solution of Einstein's equations is obtained which described the collision of a plane electromagnetic wave of constant magnitude with a plane impulsive gravitational wave.
Author (ESA)

N76-11921 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF COSMIC RAYS, INTERPLANETARY MEDIUM AND EARTH'S MAGNETOSPHERE
In its Space Res. Conducted in the USSR in 1974 COSPAR Rept., 18th Plenary Session (JPRS-65778) 29 Sep. 1975 p 32-51 Transl. into ENGLISH from the book "Kosmicheskie Issledovaniya, Vypolnennye v SSSR v 1974 Godu Doklad KOSPAR, Vosemnadtsatyy Plenum" Moscow, Izdatelstvo Nauka, 23 Apr. 1975 20 p (For availability see N76-11919 02-88)

99 GENERAL

N76-11991# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.
PROGRESS IN RADIO SCIENCE IN FINLAND, 1973
1974 29 p refs
(S-69-1974; ISBN-951-750-405-5) Avail: NTIS HC $4.00

The activities of several Finnish commissions in the field of radio science, are reported. Research includes: radio measurements and standards, radio and non-ionized media, magnetosphere, radio astronomy, radio waves and circuits, radio electronics, and radio noise of terrestrial origin. ESA

N76-11992# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.
[ACTIVITIES OF THE RADIO LABORATORY AND ITS RECEIVING STATION] Annual Report, 1973 - 1974
Martti Tiuri 1975 35 p refs
(S-70-1975; ISBN-951-750-406-3) Avail: NTIS HC $4.00

Activities in the following fields are reported: electromagnetic theory, waves and antennas, microwave theory and techniques, microwave applications, radio science and instrumentation (radio astronomy), and laser applications, e.g. satellite laser range finders and remote sensing lasers. ESA